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From Prototype to Production Machine

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BATTELLE TECHNICAL REVIEW

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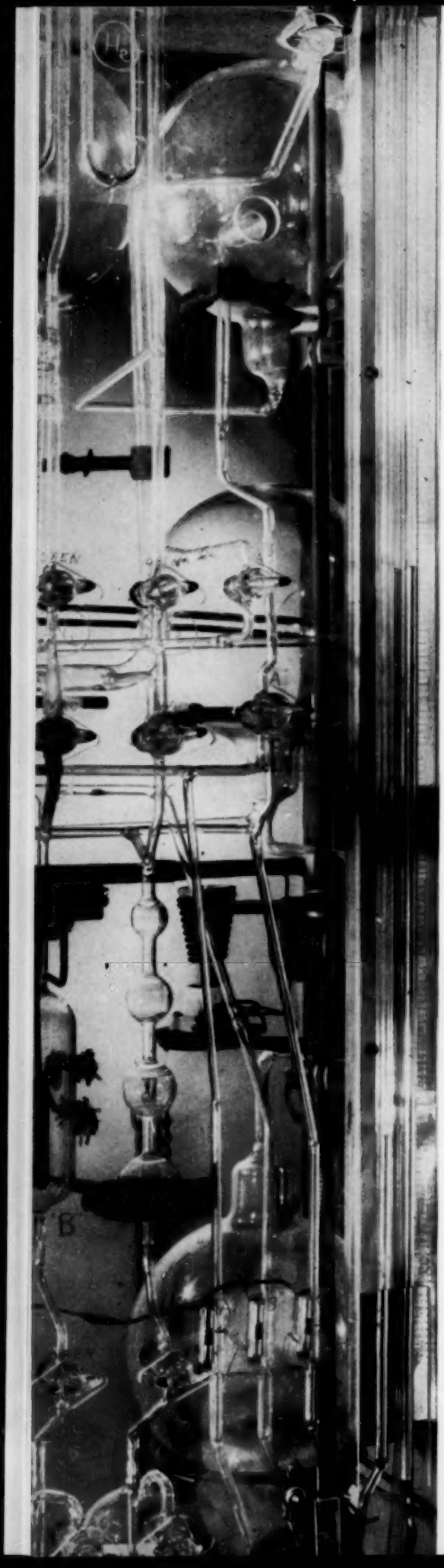


CONTENTS

BATTELLE TECHNICAL REVIEW

1 Miniature Rocket Motor

2 Battelle's New Director

3 Realities of Solar Energy
by JAMES A. EIBLING

As our energy needs increase, solar energy is certain to receive more attention. The author discusses not only ways in which the sun's energy may be utilized, but the economics of such energy, and the directions which research may profitably take.

9 From Prototype to Production Machine
by HOWARD C. DAVIS

Designers face complex problems in developing production machines from first models. A research engineer, experienced in the field, presents observations on recurring problems that may be helpful to development engineers and to management.

14 Notes from Battelle

Reports on research activities and developments of interest to science and industry.

Opposite page 16 Writings by Staff Members

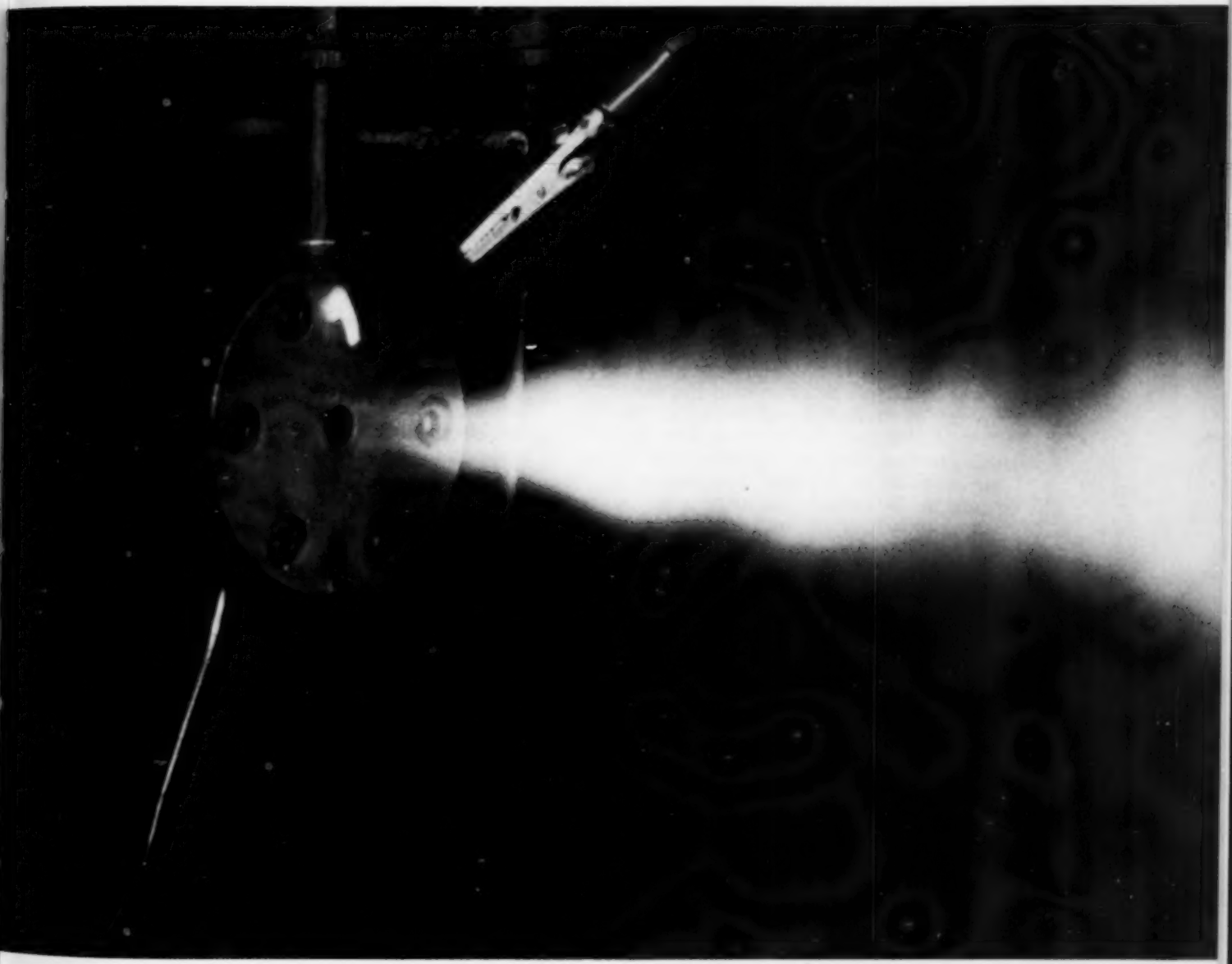
Papers and articles prepared by members of the Battelle staff that have appeared recently in books and periodicals.

153a Battelle Technical Review Abstracts

Abstracts of articles and papers in a wide variety of technological fields from more than 1350 journals published throughout the world. Abstract selection largely reflects the primary areas of Battelle research.

Adsorption apparatus used to determine surface area, porosity, and adsorption characteristics of solids.

This rocket motor, operating in Battelle's rocket laboratory, is a prototype of those used in many investigations utilizing such motors. It develops a seven-pound thrust when burning gaseous hydrogen and oxygen, and it is water cooled to permit runs of indefinite duration. Such miniature motors give performance comparable with that of larger units, but at only a fraction of the cost. The spark above the opening shows that the motor had just begun to operate.



MINIATURE ROCKET MOTOR

VIGNETTE

BATTELLE'S NEW DIRECTOR

BERTRAM D. THOMAS

The role of the research organization in our society is broader than the mere solving of technical problems, in the view of Bertram D. Thomas, Battelle's new director. He sees Battelle's role as one in which its technical competence is a means by which industry can be helped to help itself "and in doing this, it (Battelle) has helped the upward striving of human beings to improve their standard of living and to add to their well being".

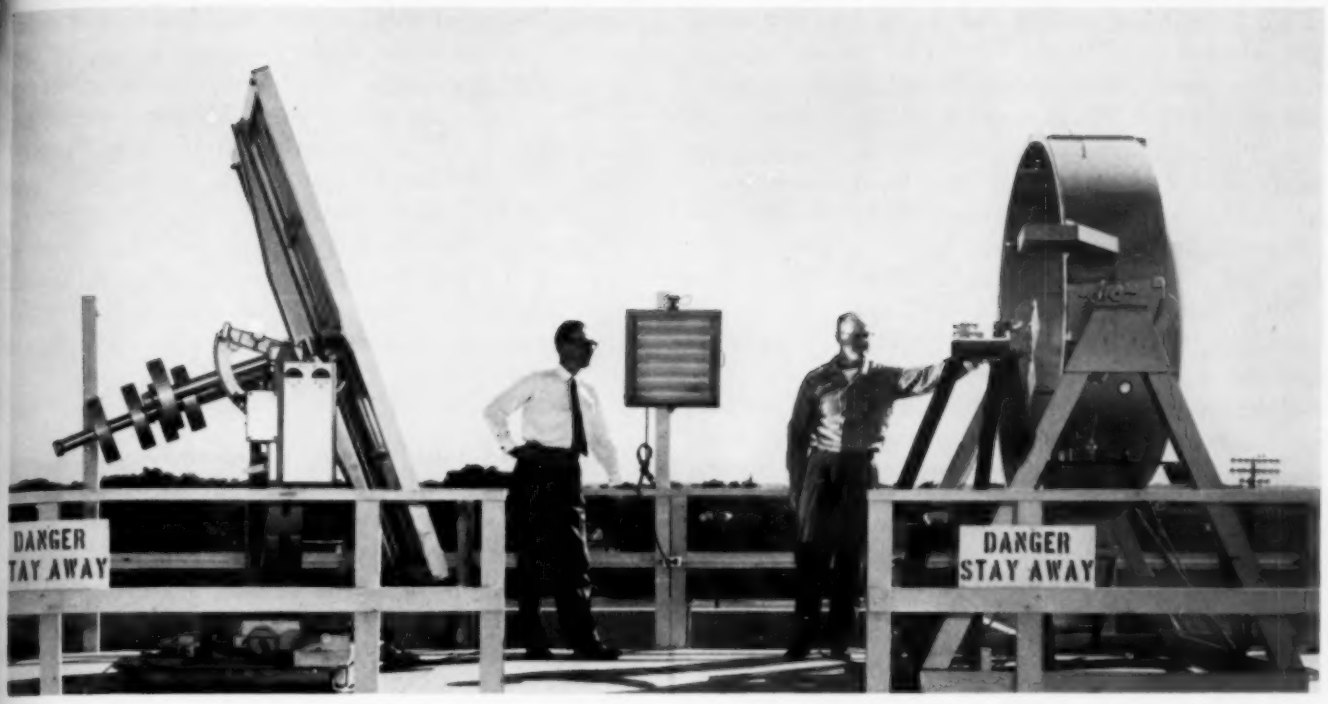
Such words reflect Bert's grasp of universals and capacity for seeing matters in perspective. Coupled with these is an ability to keep his feet firmly on the ground in those stormy situations in which there may be a great variance of opinion and in which considered judgments are needed. He is not easily diverted from analyzing the essentials of such situations. He welcomes differing opinions, yet is uncompromising on principles. Never does his keen sense of humor fail him.

Since his association with Battelle, Bert's technical and administrative responsibilities have been numerous and varied. In 1939, he established and headed the first division of chemical research at the Institute. He set up its first patent staff. He has been responsible for many of its business procedures including the form of the sponsor contract. He has been a key figure in the programming of Battelle's growing volume of research, in planning the necessary expansion of staff and facilities, in the evaluation of completed and prepared research studies, and in developing new administrative forms to meet special technological needs. He has also played a significant role in the establishment and development of the Institute's overseas operations.

Bert has always been a competent scientist. His varied scientific interests are reflected in his report, "The Technology of Iron Ore", for the President's Materials Policy Commission (1951) and in papers in the fields of physical chemistry, oceanography, ore dressing, and research management. His B.S. in chemistry and Ph.D. degrees were granted by the University of Washington, in his home state. At that school, he was recipient of a Du Pont Fellowship.

Bert's wide interests have naturally led to his membership in varied professional organizations. Among these are the American Chemical Society, the American Institute of Mining, Metallurgical, and Petroleum Engineers, Gesellschaft Deutschen Chemiker (Germany), Societe de Chimie Industrielle (France), Society of Chemical Industry (British), American Foundrymen's Society, Geochemical Society, and the Ohio Society of Professional Engineers.

With his gracious wife, Glorian, Bert shares a common interest in music and the joys (and doubtless occasional problems) of two sons and a daughter.



Solar furnaces, such as this one at Arizona State College, are useful tools in research studies of high-temperature chemical and physical reactions. With them, temperatures as high as 6300 F or higher, can be obtained. The heliostat type of furnace shown here permits the object being heated to remain fixed, while the flat mirror on the left is rotated by its mounting to follow the sun.

Realities of Solar Energy

As our energy needs increase, solar energy is certain to receive more attention. The author discusses not only ways in which the sun's energy may be utilized, but the economics of such energy, and the directions which research may profitably take.

by James A. Eibling

During the past four years, the interest among scientists and engineers in the utilization of solar energy has had a tremendous upward surge. The interest has even communicated itself to industrialists who are beginning to investigate the possibilities of manufacturing solar devices.

The likelihood of converting the sun's radiant energy directly into useful work has intrigued man for centuries. History relates numerous examples of man's endeavor in this area, beginning as early as several centuries B.C., and including besides power generation such uses as kindling of fires, opening doors of temples, cooking, comfort heating, evaporating sea water to produce salt and fresh water, melting metals, and drying foods. Until recently, however, there has been no concerted effort to develop solar devices, the subject having been largely relegated to the status of an inventor's hobby. We shall probably continue to avoid the use of solar devices as long as we have other energy in less expensive concentrated form. With the exception of photosynthesis, we can perform energy-consuming tasks more expeditiously with other forms of energy.

The Energy Situation

Why, then, should we now give serious attention to the utilization of solar energy? The phrase "so long

as we have other energy sources in less expensive concentrated form" is the key to the answer to this question. Some recent appraisals of the energy situation which take into account probable increases in population and per capita increases in energy consumption, point out that the reserves of economically recoverable fuels may be depleted within the next 100 years. Assuming that these appraisals are realistic, if we had only mineral fuels and solar radiation to consider in meeting our future energy needs, we would have cause to be duly alarmed. Needless to say, solar scientists would be among the busiest people on earth.

Fortunately, as if by an act of Providence, we also have available the important source of energy from the atom. The bases for computing reserves of nuclear fuels are not so clearly defined as those of mineral fuels and, therefore, estimates are even more conjectural. However, various estimates range from 50 to 175 years' supply of fissionable material beyond the period for which economically recoverable mineral fuels will be available. Thus, our energy supply for at least two centuries seems to be assured. This, of course, does not include the vast energy potential that would be available if atomic fusion were developed for industrial and commercial uses.

Although the discovery of nuclear energy has definitely taken the edge off the need for early utilization of solar energy, there are still some unanswered questions concerning nuclear as well as fossil fuels. More and more houses are heated with gaseous and liquid fuels, and our transportation system is almost wholly predicated on the combustion of liquid fuel. The production of oil and natural gas is expected to reach a peak and begin to decline within the next 15 years. We cannot yet justify expenditures to build plants to convert coal reserves into liquid and gaseous fuels. If we are to take such action in the future, it will be at the expense of increasing the price of fuel and the earlier depletion of reserves. The best known conversion process is not more than 50 per cent thermally efficient. Thus, it behooves us to extend the life of mineral fuels by replacing them wherever feasible with nuclear and solar energy. Nuclear specialists are extremely pessimistic that atomic energy will soon become practical for automobiles, private dwellings, and small installations of almost any type in isolated regions. Upon further analysis, it becomes unmistakably clear that the role of solar energy should be in small immobile installations. Large-scale power generation is more feasible with nuclear energy.

In contrast to nuclear energy and fossil fuels, solar radiation is the cleanest, safest, and most abundant form of energy. Each year, the earth receives from the sun thousands of times as much energy as is needed to meet the present annual energy requirement. There are no mining, transportation, or fuel processing costs. The cost of utilizing solar energy is merely that associated with the construction and maintenance of the devices for trapping the energy. The first costs can be quite high, however, because of the low concentration and intermittent supply of solar energy. These limitations are the stimuli of research which should be directed primarily toward lowering the costs of collectors and energy converters, developing energy storage systems, and increasing collection efficiency.

The Characteristics of Solar Radiation

From research carried out by solar astronomers and physicists, we have a fair understanding of the sun and its radiation. Scientists are reasonably confident that the reaction that produces the sun's luminosity is predominantly the fusion of hydrogen to helium, which takes place at temperatures of 30 million degrees. At the outer layers of the sun, the gases are cool compared to the center, being about 10,000 degrees F. According to thermodynamic laws, this temperature of 10,000 degrees F. establishes the theoretical temperature limit to which a body can be heated with solar radiation.

The intensity of the sun's radiation is greatly diminished as the radiation spreads out from the sun, obeying the law of inverse squares. Just above the earth's atmosphere, the average rate of energy incident upon a unit surface normal to the solar beam is 442 Btu per hour per square foot. This value which is called the solar constant was recently obtained by spectrographic analysis from a medium-altitude rocket.

The author joined Battelle in 1946. Since then, he has been associated with thermal systems engineering studies involving heat transfer and thermodynamic cycles as applied to heating, refrigeration, heat pumps, and solar energy applications. Among specific studies in which he has participated are residential group heating and cooling, techniques (including solar energy and thermocompression) for converting seawater to fresh water, and research on refrigerators and air conditioners. Prior to his association with Battelle, Eibling served as product development engineer with the B. F. Goodrich Company after receiving his Bachelor of Mechanical Engineering from The Ohio State University.

SOME USES OF SOLAR ENERGY

- Comfort heating
- Comfort cooling
- Heating domestic water
- Domestic refrigeration
- House lighting
- Solar cooking
- Pumping water
- Drying agricultural products
- Serving as heat source for heat pump
- Generating power up to 10 hp
- Producing fresh water from sea water
- Extracting minerals from sea water
- Providing energy for photosynthesis and other biological reactions
- Chemical synthesis
- Chemical separation
- Operating high-temperature furnaces
- Supplying energy for man-made satellites

We know also that solar radiation consists of electromagnetic waves or, in more popular terminology, photons of energy. About one-half the radiation is in the high-energy ultraviolet and visible range; the other half in the longer low-energy level, infrared bands.

Not all of the energy of the solar constant reaches the earth's surface. The major attrition is due to scattering and reflection to outer space by gases, dust, and water vapor in the earth's atmosphere. Some of the energy is absorbed. The scattering effect also converts some of the energy getting through from direct radiation into diffuse radiation. On the average, a surface located on the earth, and tilted normally to the sun's rays, receives about 60 per cent of the solar constant. The exact amount for any particular instance depends on the mean density of the atmosphere and the length of path through the atmosphere. These in turn are functions depending on the degree of cloudiness, the time of day, the season, and the latitude and the altitude of the surface. The maximum amount that has been reported is nearly 90 per cent of the solar constant, measured at the top of Mt. Whitney.

The U. S. Weather Bureau maintains daily records of solar radiation at a number of selected stations throughout the country. From these records, maps showing isolines of the mean daily radiation for each month have been prepared. These show that for the United States as a whole, roughly 1500 Btu per day per square foot is the average radiation received on a horizontal surface, but in a particular locality, the amount may vary from 2600 to less than 500 depending on the factors previously mentioned.

Techniques for Utilizing Solar Radiation

Whereas important information has already been accumulated on the nature of solar radiation, the work is by no means completed. Specific data are needed at more locations in the United States and throughout the world on the total incident radiation and on the breakdown into wave bands and into diffuse and direct constituents. Undoubtedly in time such information will be forthcoming. In the meantime, present data are realistic for use in making feasibility studies.

In regard to the utilization of solar energy, five basic interactions of photons with molecules of various substances are known. These, with examples of devices that make use of interactions, are discussed below.

Increase of Molecular Motion

All materials absorb solar radiation to some degree. In doing so, the motion of the molecules of the material is increased, thereby raising the temperature. This is the most widely used principle for trapping solar radiation. The most common device used is the flat-plate collector which, in its simplest form, consists of a surface coated with black paint or other material having a high emissivity. With such a surface, radiation of all wave lengths including diffuse radiation can be collected and converted to long-wave length heat energy. The heat can be transferred to fluids flowing inside tubes attached to the surface or to air passing over the surface. The blackened surface radiates long-wave infrared energy and this, plus convection, constitutes a heat loss. This loss can be minimized by covering the surface with one or more layers of glass or suitable plastic.

The chief limitation of the flat-plate collector is the temperature that can be obtained efficiently. The device is most effective when used in the temperature range of 100 to 175 F, although it can go somewhat higher. In this range, over-all thermal efficiencies of 30 to 50 per cent have been obtained.

Despite the moderate amount of research that has been performed, possibilities exist for further improving flat-plate collectors. These include : (1) use of tube-in-sheet heat exchangers which should appreciably reduce first cost, (2) development of selective-radiation covers and improved heat absorbers, and (3) factory evacuation and sealing of glass covers.

Besides the flat-plate collector, there are other devices for making use of the thermal effect of photons. For example, low-voltage direct current can be produced with a thermocouple by heating one junction of the thermocouple with solar radiation, and cooling the other junction with air or water. The simple solar still is another example of direct heating with the sun's rays. Also, in conjunction with reflectors, solar radiation can be concentrated on a small area to reach high temperatures.

Reflection

Certain materials having a low emissivity such as polished aluminum or silvered glass can be used to reflect photons effectively. Reflection efficiencies of 80 to 96 per cent can be obtained with smooth clean surfaces. An important use of this phenomenon is in the concentration of solar radiation. The solar furnace, wherein temperatures as high as 6300 F. have been obtained in research studies of chemical and metallurgical processes, is one example of a device using reflectivity. Solar cookers and collectors for solar engines and some types of solar stills are other examples.

The usual form of reflector is a parabolic surface which concentrates the radiation at the focus, and which must track the sun accurately to keep the aperture normal to the solar beam. Parabolic concentrators have the important advantages of obtaining high temperatures and thermal efficiencies of 70 per cent or higher. They have two disadvantages: (1) high first cost because of the need to design for wind loads and for rotation, and (2) low-energy availability during cloudy weather from an inability to concentrate diffuse radiation. Research and development on this device should be directed toward lowering the first cost and improving efficiences of reflection and of trapping of energy at the focus.

Molecular Rearrangement

The precise process whereby plants combine sunlight, carbon dioxide, and water to form a carbohydrate and oxygen in the presence of chlorophyl as a catalyst is still one of nature's secrets. However, the photosynthesis process is the classical illustration of a third type of interaction between photons and molecules. The interesting experimental work on chlorella, a single-cell water-borne plant, has shown that per acre yields of proteins, carbohydrate, and fat can be obtained far in excess of those of conventional crops. Dried, chlorella has a heating value of 13,000 Btu per pound which suggests its use as fuel as well as food.

Another example, and one that is intriguing despite the present limitations, is the photochemical decomposition of water into hydrogen and oxygen. An efficient process of this nature would be ideal for the conversion of solar energy into a form of energy for storage. The principal limitation encountered so far in the small amount of research that has been done is that only a small fraction of the ultraviolet rays of sunshine have the necessary energy level required to dissociate water by this process. Thus, the great need now is to find a system that will utilize a wider band of the solar spectrum.

Electron Disturbance

Photons absorbed by nuclei of some kinds of molecules cause a temporary deformation of the molecules. As the deformation is restored, radiant energy is emitted of a longer wave length than that received. The nature of the deformation is believed to be one wherein electrons contained in an inner ring of the molecule are forced to occupy positions in an outer ring. In the process, the displaced electrons acquire extra energy. Because of the attraction of the nuclei, the electrons are later restored to their normal positions and, in so doing, the extra energy is released as photons. In some materials categorized as phosphorescents, the photons are given off for a considerable period of time after the material is energized. Luminous paints of calcium or barium sulfides are examples of materials that yield delayed action photon emission. One application of this phenomenon might be in special paints which could be applied to the inside walls of houses. The paints, which would be regenerated by light during the day, would return the light at night and illuminate the house.

Electron Removal

When photons strike the electrons of the outer orbits of a metallic atom, one or more of the planetary electrons may fly off. The more intense the light, the more electrons are emitted. Although most metals exhibit this effect when exposed to ultraviolet rays, certain metals emit electrons when exposed to ordinary visible light and some even to infrared rays. The phototube is a well-know application of this effect.

A related device is the photovoltaic cell in which the action of light produces a difference of potential between two adjacent plates. One example of the use of this effect is the photographer's exposure meter which in one form consists of a sandwich of an iron disk and thin layers of selenium and silver, in that order. As light passes through the thin layers of selenium and silver, a voltage proportional to the light intensity is generated between the silver and the iron.

The so-called solar "battery" is another device for producing electricity directly from light. The Bell Laboratories announced in 1954 that they had ob-

The wall of this building is composed of flat plate solar collectors suitable for trapping the sun's energy for such uses as space heating, hot water heating, and comfort cooling. Such uses are most likely to receive earliest acceptance in the United States.

tained an efficiency of six per cent in converting solar radiation into electricity by means of a silicon photocell. Last year, they reported 11 per cent efficiency had been reached. This development represents a major technological breakthrough, inasmuch as prior to that time the maximum efficiency obtained with photovoltaic and photogalvanic cells was of the order of only one per cent. Researchers in this field are now talking of the possibility of obtaining 15 per cent efficiency with 22 per cent presently established as the theoretical limit. Improvements are expected to come from the use of purer materials and combinations of other materials.

The present cost of the solar battery is extremely high, mainly because of the cost of processing the materials to obtain the high purity required. However, future research and development will unquestionably result in drastic reductions of the material cost. Substantial reductions have been made in the past year.

Economics

In reviewing the various applications to which solar energy might be put, it becomes apparent that just about every conceivable use has been considered at some time or other. In some instances, the consideration has been superficial. In others, small research efforts have been expended. However, with the exception of some simple applications, such as drying of foods and solar evaporation of sea water from ponds, it cannot be said that the feasibility of any of the applications has been completely demonstrated. In fact, we are just beginning to apply the results of recent advances in technology of interaction of photons with molecules.

In general, the best possibilities for the immediate use of solar energy are in localities poor in fuel but rich in sunshine. It follows, that many of these localities are underdeveloped industrially. Such areas could be industrialized through the use of solar energy but the economics are not yet attractive because of the inability of people living in these areas to pay the first costs of equipment for trapping and storing the sun's energy. Owing to the low concentration and intermittent occurrence of solar energy, large areas of collectors are needed. Even so, it can sometimes be shown that solar energy devices are competitive with other means of supplying energy. For example, the simplest type of collector might at present cost $2 per sq ft completely installed. This would be a stationary, flat-plate collector with a single glass cover. Placed in a favorable location, such as in the Southwest, this device would yield 250,000 Btu per sq ft per year in the form of hot fluid or vapor of 150 F temperature. Assuming that ten per cent of the first cost would be representative of the annual cost of owning and maintaining the collector, the "equivalent fuel cost" of the energy delivered would be 80 cents per million Btu. This is within the range of the cost of supplying heat from the combustion of common fuels.

Applications

Residential space heating may become the first major use of solar energy in the United States. The several experimentally solar-heated houses located in different parts of the country have shown that comfort conditions can be maintained in houses heated exclusively with solar energy. In northern localities, however, it is necessary to incorporate long-term heat storage to carry through periods of sustained cold cloudy weather. As yet, long-term heat storage has not been developed to the point where it is economically

feasible. This need presents one of the momentous research challenges in the field of solar-energy utilization. Of course, we need not gear our thinking to the all-solar-heated house. Why not use solar energy for base-load heating, supplemented with electric heating which is inexpensive to install?

Comfort cooling by means of solar-heat-operated refrigeration units has received astonishingly little attention despite its apparent attractiveness. Comfort cooling is unique among all of the uses for solar energy in that the maximum cooling-load occurs at the time of maximum availability of solar energy. With the tremendous increase anticipated for comfort cooling, it is desirable to investigate in detail the feasibility of tapping the sun's energy for this purpose. Mention should also be made of solar-operated year-around air conditioning which could be accomplished by using the same collector and heat storage system for the separate heating and cooling functions. In doing so, the cost of the installation on a unit Btu basis would be greatly reduced. We could go a step further and integrate a solar hot water heater into the system. For most of the United States, sufficient solar energy could be collected on the roof of a well insulated flat-roof house to meet the combined requirements of space heating, space cooling, and hot-water heating. That is, if we can find an economical way to store heat for periods as long as several weeks.

The production of fresh water from sea water and inland brackish water can probably be ranked second, next to air conditioning in importance among possible early widespread applications of solar energy. Our planet has large areas of land that are virtually valueless due to the lack of water of sufficient purity for drinking or for irrigation. In anticipation of the time when it will be desirable to develop these regions and also as a means of supplementing already existing fresh-water supplies, a number of studies of solar distillation have been made. Current thinking in regard to solar distillation seems to favor the simple, single-effect type of device. In the Southewest, an acre of this type of still could produce about 5000 gallons of distilled water a day which is enough to irrigate up to five acres of some crops. Some estimates of the cost of producing fresh water in this manner are below $1 per 1000 gallons with further reductions predicted.

Contrivances for converting the sun's radiation into power have taken many forms. In general, they can be placed into two categories, (1) those that employ a heat cycle to produce mechanical or electrical work, and (2) those that convert solar energy directly into electricity. With some systems, over-all conversion efficiencies of up to 15 per cent are within sight. At 15 per cent efficiency, the net output during periods of high incident radiation would be about 15 watts per square foot of collector. If a suitable power storage system were available, a continuous 24-hour output of over three watts per square foot could be obtained in a favorable location.

Efficiency in itself is not necessarily the most important criterion for evaluating solar devices. It is significant mainly in that it affects the area and consequently the cost of the collector needed. For applications in nonindustrialized communities, simplicity of design and operation and minimum maintenance may be more important than high efficiency. An Italian firm has taken this approach in the development of a 2-hp solar-operated water pump. The pump utilizes a flat-plate collector in conjunction with a single-cylinder, slow-speed vapor engine. This product has attracted world-wide attention.

The outlook for large-scale power production with solar energy is not encouraging because of the extreme variability in output and the extensive surfaces that would be involved. Until we find a cheap, convenient way to store energy, we may as well omit this application from consideration. It is of interest to point out, however, that even with existing conversion efficiencies, the desert areas of the world receive far more than enough solar radiation to supply present power needs. But how would we transport the power?

The Future

In regard to the future, we seem to have no choice but to accept the fact that the reserves of fossil and nuclear fuels are limited and to plan for the exploitation of solar radiation, the only inexhaustible source of energy. As mineral and nuclear fuels become scarcer and rise in price, solar energy will become more competitive despite its disadvantages of intermittency and low concentration. Already, the solar approach shows promise for space heating and cooling, water heating, and distillation of sea water. In nonindustrialized arid regions, the performance of simple tasks with solar devices will help raise living standards.

If we wish to speed the day when solar energy will be competitive on a broad basis, much research will be needed. This work should include fundamental investigations into the basic reactions of photons with molecules as well as applied research in heat transfer, chemistry, metallurgy, mechanics, and solid-state physics. The manufacture of low-cost, efficient devices for trapping and utilizing the sun's energy and inexpensive dependable systems of storing energy can be listed as important end-products of the research.

The specific purpose of this prototype mail-handling machine was to evaluate and demonstrate the feasibility of new operating principles.

From Prototype to Production Machine

Designers face complex problems in developing production machines from first models. A research engineer, experienced in the field, presents observations on recurring problems that may be helpful both to development engineers and to management.

by HOWARD C. DAVIS

OVER THE PAST DECADE, American industry has experienced a general trend of increased production costs. These cost increases can, in turn, be traced to corresponding rises in costs of materials and labor throughout industry. As a result, industrial management maintains a close watch on its labor productivity rates and production rejections for quality reasons. When either productivity or product quality is considered to be nearing a competitively low level, the possibility of designing and developing special machines to improve these conditions is seriously considered.

Having decided to embark on a machine development program, a company's usual engineering procedure consists of three steps. First, a general idea of the required machine components is conceived and a layout design is prepared which illustrates in simplified design form the position in space, the approximate sizes, and the operating interrelations of the important machine components in the design concept. It is the objective of this layout design work to provide bases for evaluating and estimating the probable complexity and feasibility of the ultimate machine.

If the layout design work indicates that ultimate development of the required machine is feasible and practical, the second step is taken—design and construction of an experimental prototype, or "first model", of the machine. After experimenting with this prototype unit, a third engineering stage follows which consists of the construction and development of the

final production machine. In some cases, many duplicate units of the final production machine may be ultimately required. In that event, the production model referred to in these discussions is considered a "production prototype" because it may subsequently be redesigned slightly to simplify quantity reproduction. The discussions apply equally in either case.

The usual prototype model can take many forms. With simple mechanisms or machines, it may be only a wooden model of the envisioned machine linkage and may be operated by hand to illustrate and prove out the conceived machine mechanism. In other cases, the prototype may be a powered working unit which is reduced in complexity, size, or scale to evaluate the conceived operating principles conveniently and reliably. In still another typical case, the prototype may actually be several separate machines which individually perform discrete functions but which are planned to be assembled together and integrated into one final production machine. Regardless of the form of the prototype in any individual circumstances, a period of engineering design and development is required between the prototype and production machine stages.

After experience has been obtained with the prototype unit, and the operating features have been judged to be feasible, a decision to proceed with development of the production machine must be made. This decision is based primarily on economic factors. Such factors include the total anticipated costs of the machine development, and additional machine units, labor savings which should result, and the reductions expected in scrap rejection or in product re-work requirements. When the potential product savings are reduced to terms of dollars, comparison can be made with the over-all estimated cost of research and development for the production machine. It is the usual practice of manufacturing business to expect amortization of the machine development cost from the anticipated production economies within a period of one to two years. A longer period of amortization may be tolerable in unusual cases, but is exceptional.

Because the economics of the situation are such a significant factor in this policy decision, the engineer's role is extremely important at this point—it is his responsibility to predict, with reasonable accuracy, the probable time and cost that will be involved in the "prototype to production" effort. The engineer, in planning the program and cost estimate to complete the development project from prototype to production machine, must base his predictions on average experience with such programs, although actual experiences will show material deviation from this assumption of program complexity. At the prototype stage, however, bases for predicting an ensuing simple or difficult engineering program are often not evident. Reliance can, therefore, only be placed upon a prediction of "average" complexity or difficulty in preparing estimates of cost and time for such a project.

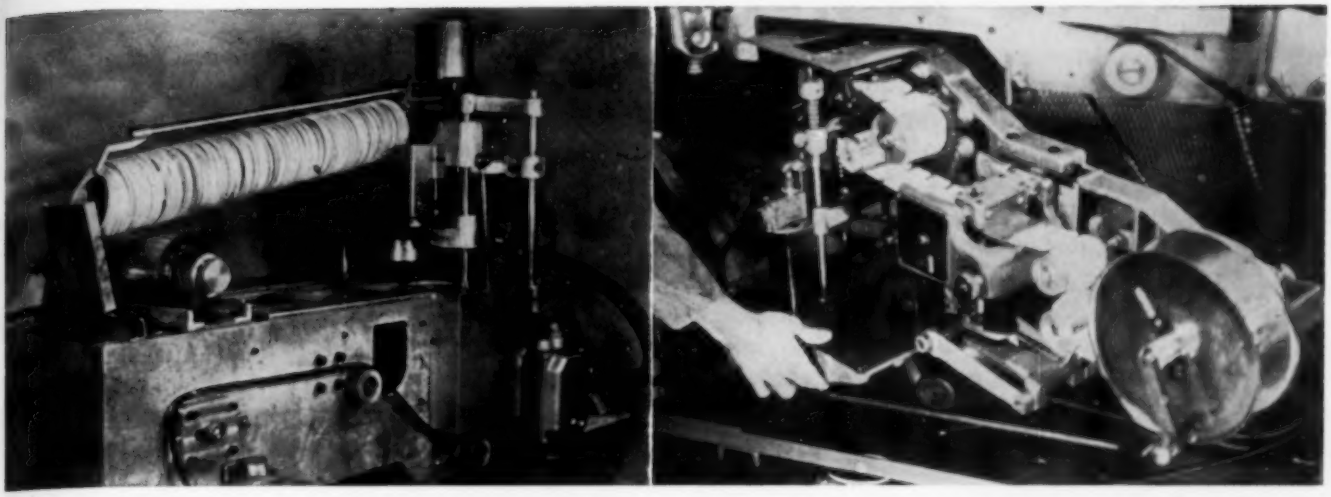
The major difficulty in predicting development requirements is the uncertainty concerning the nature of problems which will be experienced during the program. It is advisable, therefore, to explore past experiences in development of machinery from prototype to production and to examine some typical difficulties encountered in these programs. Such a review is intended to expose the existence of recurring problems. While universal measures to overcome these problems cannot be cited, awareness of their existence and recurrence, through this review, may prove of value in in the planning and conduct of such programs.

Machine Cycle Speed

A major problem in many production development programs is the attainment of maximum machine cycle speeds. Cycle speed establishes the gross productivity of the machine. Therefore, it is required that the machine must operate at the maximum possible speed or cyclic rate. Unfortunately, the maximum speeds established in prototype work may be impractical for the production machine because prototype experimentation is usually limited to short runs. When long high-speed runs become possible, various limitations on speed often become apparent. Durability, wear, and operator safety, for instance, impose practical limitations on the operating speed aside from the strict ability of the machine mechanisms to move or to perform dynamically at high speed.

One major limit on operational speed is its effect on durability and wear of such components as bearings,

Howard Davis, who is chief of Battelle's manufacturing engineering division, has been associated with the Institute since 1944. During this period, he has participated in and directed research and development of production equipment in diverse fields. These have included automotive manufacturing, graphic arts, chemical processing, food handling, mining, metal working, packaging, and brush ware. Prior to joining Battelle, he served as a test engineer in the Detroit Diesel Engine Division of the General Motors Corporation and as a member of the faculty of the School of Engineering at the Ohio State University. Davis received his Bachelor of Mechanical Engineering from that institution.



A prototype packaging machine which requires the mechanical compounding of several operational functions. At right is exposed mechanism which is not visible in the other photograph.

slides, cams, followers, and gears. A limit on speed exists for any machine beyond which mechanical development problems increase at an extreme rate. Also, the machine loadings and stresses produced by sudden stoppage of the machine from jams can contribute a practical speed limitation. Another important limit on operating speed is operator safety. If the operator must work close to the machine or perform manual operations in synchronism with the machine movements, personnel hazards from rapidly moving machine parts may result. Further, the nature of some processes precludes full enclosure of the machine mechanisms to protect the operator completely.

Experience has shown, therefore, that a variety of conditions in the machine development program can severely limit machine cycle speed. Further, it is often impossible to evaluate these limitations in original work with the prototype unit.

Machine Durability

Durability of the machine components represents another major problem to be solved in a development program. This problem may occur at locations in the design which are not evident to the engineer at either the design or prototype stage. The location and severity of these problems, therefore, come to light only during the development work. For example, shafts, bearings, gears, or other parts may have to be changed in size or location for durability reasons. However, a set of limitations on the re-location and re-design of components now exists because of the surrounding machine structure which, by this time, has been designed and constructed. Therefore, in the design stage, the engineer is responsible for predicting the troublesome areas and keeping these areas as clear as possible to accommodate alterations and modifications that may subsequently be required.

An obvious approach to the prevention of durability problems would be to design each component excessively heavy and rugged. However, if this course is generally followed, the entire machine structure will grow out of proportion to the job it is to perform, problems of vibration and balance will occur, and an over-all ridiculous design can result.

The only practical approach is to design components for production service intelligently according to the known loadings, stresses, and operating conditions to which the machine will be exposed. Further, the engineer should mentally catalogue the possibilities for later alteration of each component and, where possible, make provisions to accommodate these alterations spacewise should they prove necessary.

Materials Variation

A problem frequently encountered in the development work is variation in raw materials or components to be processed, handled, or assembled. Changes in characteristics or properties of these materials may arise from the need for slightly modified materials, from the procurement of materials from a new supplier, or from variations in quality which occur during long production runs. These variations may not appear in short runs of experimentation with prototype equipment. For instance, with metal-working machines, a slight variation in material properties may result in tool life problems or in substandard dimensional tolerances. Also, changes in surface characteristics of the materials may seriously affect transfer methods for

feeding and handling stock or components in the mechanized process.

As an example, a decision was made for economy reasons to alter the plating on a part which had been handled and assembled successfully in prototype equipment. The resulting change in surface characteristics, arising from the revised plating material, created a feeding problem within the manufacturing machine which had not occurred in the prototype unit.

Paper-handling equipment is often susceptible to slight changes in paper stock. Paper-handling systems are also subject to mechanical problems caused by atmospheric humidity changes. Similar considerations apply to production equipment processing or utilizing yarns or fibers in their operation.

In some other cases, special production equipment is developed for integration into an existing continuous production line in which the new machine continuously receives material directly from the raw producer unit. On the prototype scale, such equipment may operate successfully when interrupted batch quantities, removed from the raw producer unit, are used remotely in the prototype machine as representative of the product to be processed. In actual practice, however, when the final machine is integrated into the production line, product variations can become apparent and affect mechanical operation seriously. Thus, short-term aging effects may have resulted in a nontypical material being fed into the prototype equipment. Notorious in this respect are some plastic materials, and certain food products.

Set-Up or Change-Over Requirements

One item often minimized or not fully appraised at the prototype stage is the time and labor requirement necessary to alter the production machine, so that it may accommodate desired variations of size and shape in the basic product. Some production machines do not have to be capable of adjustment for product variation. Certain products, however, must be manufactured in a variety of sizes, shapes, and forms, and equipment for their production must be adjustable to accommodate these required variations. In this category are items such as paint brushes, building hardware, tools, cutlery, and others.

The prototype unit, which is usually in rudimentary mechanical form, may appear to be easily convertible for tooling changes. However, in the process of modification and revision during the development program, the final form of the production machine can easily lose this freedom of access and ease of tooling alteration. The engineer must be vigilant during development to maintain the ease of access and tooling alteration which characterized the prototype model. An available alternative is to provide, within the machine, multiple toolings to accommodate required product variations. This alternative may result in complicated design development difficulties, and maintenance problems, but is often necessary under certain design and operating conditions.

Mechanical Compounding

Another problem includes the combining of several prototype machines, each performing a single function, into a combined or integrated production machine. Each prototype unit, when evaluated separately, may be potentially capable of a rather high degree of mechanical reliability. It might, therefore, be assumed that the separate mechanical functions can be safely combined into a single integrated production unit whose over-all mechanical reliability would correspond favorably to the high reliability level of each unit.

The integration of a large number of separate mechanical devices into a single machine can prove to be an extremely costly and lengthy development program, even though the mere combining of these units appears relatively simple and straightforward. A primary problem in this case is mechanical reliability, the reliability being indicative of the time the machine is operating and is not shut down for clearing of jams, adjustment, tool replacement, repair, or maintenance.

Consider a typical case. The engineer may be called upon to combine eight mechanical prototype units which are to operate sequentially in production-line fashion within a combined machine. Each separate mechanical unit hypothetically operates at a mechanical reliability factor of 95 per cent. Individually, this factor may appear attractive because it implies a maximum "down time" expectancy of only 5 per cent. However, in the combined machine, a shut down of any one operating mechanism enforces a shut down of all other seven units. All eight operations must be halted because of the interrelation of their operations. Therefore, even with individual reliability factors of 95 per cent, the over-all mechanical reliability of this combined machine could be less than 70 per cent. Few mass production operations could tolerate such a low reliability performance.

In the development of this hypothetical production machine, the engineer would have to select one of two approaches to improve the low reliability factor. One approach would be to combine the hypothetical eight functions into two separate machines—Machine A to combine perhaps the first four sequential manufacturing operations, and Machine B to combine the remaining operations. If a surge capacity in the flow of the

product is provided between Machines A and B, either machine could be shut down temporarily without interrupting the operation of the other machine. In this example, an overall reliability factor of over 80 per cent should be theoretically attainable.

The alternate approach would be to retain all eight functions in the combined machine. The mechanical reliability of all functions would then have to be increased through design, experimentation, and development efforts. Increasing the reliability of each of the eight operational units to 98 per cent should assure an over-all reliability of 85 per cent or more.

No hard and fast rules apply to the selection of one approach over the other. The engineer can only be guided by his judgment in any individual case as to the more productive approach.

Labor Reception

Often a significant problem for the development engineer is the final stage in development where a production operator assumes operation of the machine in production. Among engineers, it is said that the production operator can make or break the chances for ultimate success of the finally developed production machine. Although this statement may not be universally true, it is substantially correct in a large number of cases. Unfortunately, there is little that can be done in the engineering design or development effort to assure enthusiastic reception of the machine by the operating personnel.

The reasons for lack of enthusiasm and even resistance to the plant installation and operation of a novel production machine are many and varied. Typically, they seem to be characterized by human resistance to change in the basically routine and repetitive daily work procedures. Operation of the new machine necessitates: (1) some revision in these routines, (2) the necessity for acquiring an understanding of the new operations, and (3) possible requirements for attaining some new or different skills. Concern also exists in the mind of the operating personnel as to how the machine will affect their own personal security in the company.

It is, therefore, important that some intelligent salesmanship be directed toward the operating personnel as an integral part of the over-all engineering development program. Further, this selling task is most effective when instituted prior to the completion of the development program to alert and familiarize the production group with the coming changes. Awareness of such future changes before their inception tends to inspire confidence and cooperation and enhances the probability of ready acceptance of the production machine when it is finally prepared for plant use.

Experience has shown that the responsibility for this effort should normally lie with company administrative officials. This approach emphasizes company solidarity behind newly instituted equipment and procedures and tends to discourage resistance to the modified operations which will result. Also, if possible, a premium wage arrangement should be devised for the new machine-operating personnel. This wage upgrading should reflect the expected improved productivity of operator and machine and the assumption of responsibilities by the operator associated with the machine and its operation.

The engineer can make some contributions mechanically to enhance the probability of ready acceptance of the machine by operating personnel. The primary requirement is that the machine be engineered to be as trouble-free as possible and require a minimum of repair and maintenance attention. The machine should not be rushed into production service until it is thoroughly developed, because the operational excellence in initial trials is always important to the acceptance of new equipment. Insofar as possible, the machine should be relatively neat and attractive in an effort to instill a sense of pride in the operator. The machine should also be as safe to operate as is commensurate with the manufacturing process which is involved. Finally, the machine should be designed to be free as possible from disagreeable operating noise, vibrations, and odors which would otherwise tend to promote operator resistance.

Conclusion

Of the three engineering phases in the preparation of novel production equipment, the production development phase is one most frequently minimized or misunderstood by those who are infrequently exposed to this type of engineering effort. An understanding of such development programs and their problems is important, because the development phase of the production machine is usually the most costly and time-consuming portion of the entire engineering program.

The magnitude of the development problems which will be experienced in an engineering development program can usually not be accurately predicted. Therefore, deviations from the engineering cost estimates must be expected occasionally.

Although specific development problems cannot be reliably predicted, experience has shown that certain difficulties are typically and frequently experienced. These include problems of durability, machine speed, set-up requirements, materials variations, mechanical compounding, and labor reception.

NOTES from BATTELLE

* MEETING OF BATTELLE TRUSTEES

At the year's end meeting of Battelle's board of trustees, Dr. Zay Jeffries, noted metals scientist and retired vice president of the General Electric Company, was re-elected chairman of the board.

Retaining positions on the Battelle board of trustees with Jeffries are Gerald B. Fenton, first vice chairman and treasurer; Harry M. Runkle, second vice chairman; J. C. Miller; Clyde Williams, Battelle president; and Dr. Roger Adams, past president of the American Chemical Society and of the American Association for the Advancement of Science.

Newly elected Institute secretary is E. E. Slowter. He will continue to serve as business manager and assistant treasurer. Reappointed as vice presidents were Dr. B. D. Thomas, the Institute's new director; David C. Minton, Jr.; and John S. Crout.

Dr. Thomas announced, simultaneously with the election of officers, formation of an executive committee. Thomas, Williams, Crout, Minton, and Slowter comprise that committee. It will guide the development and carrying out of Institute policies and research operations in the United States and Europe.

Summarizing other action by the board, Dr. Thomas disclosed that authorization was made for purchase of an additional 109 acres of land near the 400-acre site of Battelle's nuclear research center just outside Columbus. Dr. Thomas pointed out that the acquisition will insure adequate room for long-range expansion but said no immediate plans for its development are contemplated. The buildings to be constructed at the central laboratory in Columbus include a one-story engineering laboratory and a five-story office-type building. The engineering laboratory will house heavy machines, engine research and structural research facilities of Battelle's Mechanical Engineering Department. The office-type building will afford a central location for the Institute's engineering economics, management services, and other desk research operations and its administrative and research service groups. Approval was given also for extension of the Institute's educational program to allow research staff upgrading through Battelle-underwritten post-graduate studies at neighboring Ohio State University in Columbus.

Among the highlights of the Institute's research operation in 1956, board members cited completion of the nuclear research center—hot cell laboratory, reactor development laboratory, and 1-megawatt research reactor; dedication of Europe's first Univac computing center at the Frankfurt, Germany, laboratory, and growth in research staff and volume of sponsored research at the Institute's three laboratories. In Columbus, the staff growth for the year was 20 per cent, and the dollar volume of sponsored research exceeded $20 million. At Geneva, Switzerland, the volume of research more than doubled in 1956, while the Frankfurt laboratory experienced an increase of approximately 80 per cent in the volume of research.

* IMPROVED NITRILE RUBBER

A search for a rubber composition with increased resistance to diester-type lubricants at 350 F was made at Battelle. One of the types of rubbers included in this investigation was the nitrile type. These rubbers are copolymers of butadience and acrylonitrile. While this type did not swell excessively, it cracked and degraded drastically after 72 hours exposure to hot diester lubricant.

R. A. Clark and W. H. Gillen of Battelle report that a magnesia-loaded nitrile rubber compound has been developed at the Institute which has better diester-resistant properties than were previously available in such compounds. The new composition, developed for the Materials Laboratory, Wright Air Development Center, has withstood severe aging conditions for 168 hours before surface-cracking occurred.

* GROWING NUCLEAR BUSINESS

The growth of atomic energy as a business and consideration of its future possibilities, was the subject of a recent talk by Battelle's Clyde R. Tipton. Speaking before the Great Lakes States Industrial Development Council, in Peoria, Illinois, he pointed out that governmental expenditures on atomic energy in the United States increased from

$140,000 in 1940 to $1.6 billion last year. In all, about $16 billion has been spent or appropriated for atomic energy developments since the beginning. Fixed plant investment of AEC installations, Tipton pointed out, is about $6.8 billion exclusive of inventories.

Referring to a recent survey by the Atomic Industrial Forum, Tipton stated that the annual rate of expenditure in atomic energy may be $2.0 billion per year by 1965. The Forum survey sees the breakdown of expenditures in 1965 about as follows: reactor vessels, $120 million; control apparatus, $80 million; heat exchangers, $70 million; pumps, $104 million; valves and fittings, $40 million; tanks and auxiliaries, $30 million; instrumentation, $70 million, and fuel handling, $60 million, for a total of about $600 million.

Tipton declared that the largest single use of nuclear power that can now be foreseen is in the generation of competitive power in large central stations. He also expressed the opinion that the business benefits and new business resulting from atomic power will probably far outweigh the large, single advantage of the additional power available.

* AMINO ACIDS IN MACARONI

One of the current emphases in food manufactures is the enhancement of the protein content of foods. Among the foods that have been modified along these lines are pasta, or macaroni, products.

A recent investigation, conducted by C. Lataste-Dorolle, of the bioscience division of Battelle's Geneva laboratory, and E. Finzi, head of research of S.p.A. Gio & Filli Buitoni, of Sansepoldiro, Italy, made use of microbiological techniques for the assay of amino acids in macaroni to which additional wheat proteins has been added.

Protein hydrolysis was accomplished by the use of barium hydroxide, and tryptophane was assayed with *Lactobacillus arabinosus* 17-5. *Leuconostoc mesenteroides* P-60 was used in the determination of lysine, leucine, isoleucine, arginine, phenylalanine, and methionine. Growth responses of the test organisms were determined by measurement of turbidity and acid production in test cultures by standard methods.

The information obtained in these studies was used to determine amino ratios in both low and high protein macaroni. As a result of this study, it has been shown that the lysine-to-tryptophane ratio, which is normally 2 to 2.5 in "plain macaroni", can be increased to 4.5 to 4.7 in "gluten macaroni" by adding wheat germ protein.

* MOLYBDENUM-BASE ALLOYS

A four-year investigation of molybdenum-base alloys prepared by powder-metallurgy methods was summarized late last year, by Robert I. Jaffee of Battelle, before the Symposium on Molybdenum of the Office of Naval Research. The investigation, conducted at Battelle for the Aeronautical Research Laboratory, Wright Air Development Center, led to considerable knowledge about the properties and advantages of the alloys as well as about the mechanisms for producing them.

Jaffee pointed out that the major difference between the best molybdenum-base alloys prepared by powder-metallurgy as compared with arc-casting methods is the superior hot breakdown fabrication characteristics of the former product. The underlying reason for this difference appears to lie in the finer initial grain size of the as-sintered powder-metallurgy alloy, and the fact that the impurities are distributed over a much larger grain-boundary area, thus making their presence innocuous. The room- and elevated-temperature strengths of the best molybdenum-base alloys prepared by powder-metallurgy methods are equivalent to those of the best arc-cast alloys. However, because of higher oxygen contents usually found in powder-metallurgy-produced materials, the ductility of thin weldments is inferior to that of arc-cast alloys.

Initially, powder-metallurgy alloys made with conventional alloying additions were studied. The most effective alloying addition was silicon. Significant improvements in strength at room and elevated temperatures could be achieved with silicon alloy contents of the order of 0.1-0.2 per cent. Chromium also was found to be a good conventional alloying addition. One to two per cent may be added. These amounts improve room- and elevated-temperature strength and increase the recrystallization temperature range. Cobalt was found to have a high strengthening effect, but lowered the recrystallization range. The addition of tungsten resulted in alloys with excellent mechanical properties and improved recrystallization characteristics; however, tungsten had the lowest specific strengthening effect of any alloying addition and was not advantageous from a strength-weight point of view.

A new type of alloying addition to molybdenum was discovered in this research in which the addition of stable oxides produce dispersion hardening. The most suitable oxides were those which were available in the finest particle size, had high hardness, high stability, and high modulus of elasticity. The oxides of zirconium and titanium were most effective, with chrome oxide good, but somewhat less effective. The oxide-dispersion alloys of molybdenum with 0.1-1 per cent ZrO_2 or

at 1800 F or three to four times that of unalloyed molybdenum.

The optimum alloys produced by arc-casting methods are those containing titanium or zirconium, the same elements which were found to be most effective when added as oxide dispersions to powder-metallurgy molybdenum alloys. It was concluded that the mechanism for improvement in elevated-temperature strength was similar in both cases, part of the metallic alloy addition in the arc-melted alloys being oxidized during melting to produce fine dispersions of oxide.

The economic differences between arc-cast and powder-metallurgy molybdenum products are important. Thus, if advantage is taken of furnace sintering procedures, there will be almost no scrap generated in the primary breakdown operation of powder-metallurgy alloys. In the case of arc-cast alloys, on the other hand, the end losses in extrusion are inevitably high. However, if true hot-working procedures make a direct hot breakdown operation feasible for arc-cast alloys, the economic advantage disappears.

* FLOW OF RESEARCH FUNDS

The National Science Foundation has released a report analyzing research and development expenditures of the various sectors of the economy—the Federal Government, industry-oriented organizations, colleges and universities, and other institutions. The analysis covers these sectors both as sources of funds and as performers of research and development.

Using 1953 as the survey period, NSF estimates that $5.4 billion were spent for research and development. This was 1.5 per cent of the gross national product of $363.2 billion.

The Federal Government and industry-oriented sectors participated about equally as sources of funds. The Government supplied $2.8 billion, industry, $2.4 billion—totalling about 96 per cent of all research and development planning. Colleges and universities provided $130 million or three per cent and other institutions (including research institutes) $50 million, or one per cent. The figure for colleges and universities does not include such contributions as salaries of investigators and other contributions.

As performers of research and development, the industry-oriented sector spent almost three-fourths of the total funds, the Federal Government only 18 per cent. Colleges and universities, on the other hand, reported three times the dollar value of research performed (nine per cent of total) as compared with what was self-financed. The Federal Government used about one-third of its funds for conducting research, in its own laboratories, spending the remainder in other laboratories. Industry on the other hand, with the exception of a small amount going to colleges and universities, used almost all its funds in its own organization.

* Dr. Sherwood L. Fawcett has been appointed assistant manager of the department of physics at Battelle. Fawcett, a specialist in nuclear engineering and heat transfer, will direct much of his time to expanding the activities of the Department.

* William H. Goldthwaite has been appointed chief of the engineering mechanics division at Battelle. In this position he will direct research dealing primarily with mechanics, heat, friction, and wear. One major phase of the division's research involves the design of bearings and other mechanical components for operation at extremely high temperatures and in unusual liquid and gaseous environments.

* A summary and analysis of a continuing study of the creep buckling of aluminum columns, by Battelle metallurgists R. L. Carlson, E. G. Bodine, and G. K. Manning, has been issued by the Office of Technical Services. Results include behavior data for short, inelastic columns of 2024-T4 aluminum alloy, square tubing, columns of 2024-T3 aluminum alloy, and columns of stainless steel 17-7PH. Copies of the report (PB121465) are available from the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C.

* The Air Force has released a report of Battelle investigations on a forgeable chromium-rich, chromium-iron alloy suitable for turbine buckets in turbo jet engines. The report describes production of experimental alloys (70 Cr, 30 Fe, 9 Mo, 2 to 3 Tr, and up to 5 Al) by induction melting charges of commercially available stock, casting into molds, and fabricating by various hot-working methods. Forged bars are reported to have remarkable thermal-shock properties up to 2000 F. The report (PB 12 11 11) by D. P. Moon, H. A. Blank, and A. M. Hall, may be ordered from the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C.

Writings by STAFF Members

Journal of Metals; American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, January, 1957, contains the following articles by staff members.

Structure of the Transition Phase Omega in Ti-Cr Alloys. A. E. Austin and J. R. Doig, pp. 27-30.

These alloys harden after β-quenching by formation of an ω-phase. The hardness appears to be caused by strain in the β-matrix produced by concurrent enrichment of the alloy content in the ω-phase.

Engineering Aspects of Ion Exchange in Hydrometallurgy. John Dasher, A. M. Gaudin, and R. D. MacDonald, pp. 185-192.

A strong base anion exchange resin is used for selective recovery of uranium from sulfate leach liquors. The influence of the major variables on column operation is described, plant performance data are summarized, cost factors are enumerated, and the probable application of this operation to metals at least as valuable as copper is predicted.

Symposium on Titanium II Mill and Fabrication Economies. S. A. Gordon, pp. 167-172.

Aluminum and titanium are compared as materials for aircraft fabrication. Recent accumulation of knowledge concerning titanium should reduce the cost problem.

"Transactions of the American Foundrymen's Society", vol. 64, 1956, contains the following articles by staff members:

Service Life of Iron Castings Can Be Affected by Their Thermal Conductivity. J. A. Davis, H. W. Deem, and H. W. Lownie, Jr., pp. 223-226.

Quantitative data are given on the coefficient of thermal conductivity of five irons between 150 F and 600 F. Four service conditions which make thermal conductivity an important factor in design and service are discussed.

Modifications in Vertical-Gating Principles. K. R. Grube, R. M. Lang, and J. G. Kura, pp. 54-61.

Further modifications were made on an improved vertical-gating system described earlier, to improve the system without increasing the degree of turbulence within the mold cavity or without increasing the probability of getting dirt or dross into the castings.

Members of the Battelle staff are authors of the recently published articles and books listed on this page. In most cases, reprints are available from the Battelle Publications Office, 505 King Avenue, Columbus 1, Ohio.

Use of Pig Iron in Iron Foundries (With Particular Attention to Specifications, Prices, Secondary Elements, and "Heredity"). H. W. Lownie, Jr., pp. 104-124.

Covers pig iron classification, analysis, principal uses, prices, effects of primary and secondary elements, nodular and malleable iron castings manufacture, and pig iron "heredity".

Stress-Strain Relationship for Gray Iron. E. M. Stein, pp. 214-216.

Medium- and low-strength gray irons are studied; stress-strain graphs are curved from the origin, showing that these irons do not have a true modulus of elasticity.

Influence of Temperature on Mechanical Strength of Coke. John Varga, Jr., and H. W. Lownie, Jr., pp. 217-222.

The mechanical strength of coke at room temperature gives no indication of its mechanical strength at the higher temperatures encountered in cupola operation. A test method is developed which is adaptable to a wide variety of materials.

Electrical Properties of *n*-Type InAs. T. C. Harman, H. L. Goering, and A. C. Beer. *Physical Review,* December 15, 1956, pp. 1562-1564.

Hall coefficient and resistivity were measured as functions of temperature. A room temperature mobility of 30,000 sq. cm. per volt sec. was obtained for a donor concentration of 1.7×10^{16} atoms per cc. For this impurity density, no indication of a separation of the donor level from the conduction band was observed.

Electrodeposition of Porous Nickel-Cadmium Alloy. L. D. McGraw, J. P. Spenard, and C. L. Faust. "Technical Proceedings of the 43rd Annual Convention of the American Electroplaters' Society", pp. 209-210.

Porous alloy deposits were obtained from a bath containing Ni and Cd salts and colloidal graphite. The effects of bath pH and other process variables were studied. The composition of the deposited alloy is very sensitive to changes in bath composition or current variations.

Welding of Molybdenum Heat Exchangers. R. E. Monroe and D. C. Martin. *Welding Journal,* December 1956, pp. 1222-1225.

The feasibility of producing complex welded components in currently available arc-cast molybdenum was demonstrated by the construction of simulated heat exchangers. Assemblies containing 52 tubes welded into a header sheet was completed with no failures occurring as a result of room-temperature brittleness of the welds.

Properties of Electrodeposits at Elevated Temperatures. W. H. Safranek and G. R. Schaer. "Technical Proceedings of the 43rd Annual Convention of the American Electroplaters' Society", pp. 105-117.

Properties such as oxidation resistance in air, stress rupture, thermal expansion, thermal stability, ductility, and hot hardness were determined for Ni, Cr, and other electrodeposits. The results of the research showed promising leads for developing improved electrodeposits for protecting Mo and other metals against oxidation at high temperatures.

Basic Principles of Gas Partition Chromatography. Charles L. Teitelbaum. *American Perfumer and Aromatics,* December 1956, pp. 19-21.

Simplicity, ease of operation, scope, and efficiency of the method indicate great potentialities for the essential oil, flavorings, and cosmetic industries. Details of the apparatus are given.

Science, Technology, and Trade. Clyde Williams. *World Science Review,* January 1957, pp. 9-14.

After noting the rapid growth of industrial research in the U. S. and its effect on our economy, encourages similar development in Britain with particular emphasis on problems associated with the lack of many basic raw materials.

WORLD-WIDE ABSTRACTS

in the FIELDS of

153a Aeronautical Engineering
154a Agriculture
155a Biochemistry and Biophysics
157a Ceramics and Concrete
158a Chemical Engineering
160a Chemistry—Analytical
162a Chemistry—Inorganic and General
163a Chemistry—Organic
167a Chemistry—Physical
171a Coatings
172a Control Systems, Computers, and Systems Engineering
174a Electrical Engineering
176a Electrochemistry
177a Electronics
181a Engineering Economics
182a Fluid Mechanics
183a Food Technology
183a Fuels and Combustion
184a Geology, Geophysics, Mineralogy, and Mining Engineering
186a Graphic Arts
186a Heat Power
187a Information—Preparation and Dissemination
187a Instrumentation
189a Lubrication and Friction
189a Mechanical Engineering
191a Metallurgy
192a Metals—Corrosion
193a Metals—Extraction and Refining
194a Metals—Finishing, Polishing, and Cleaning
194a Metals—Foundry Practice
195a Metals—Heat Treatment
196a Metals—Mechanical and Physical Properties
199a Metals—Mechanical Working
200a Metals—Metallography, Transformations, and Structures
202a Metals—Powder
202a Nondestructive Testing and Quality Control
203a Nuclear Physics, Nucleonics, and Radiation
208a Operations Research and Management Engineering
209a Ore and Materials Beneficiation
209a Physics
213a Plastics
214a Pollution and Wastes
215a Rubber and Elastomers
215a Space Heating and Conditioning
216a Textiles, Fibers, Leather, and Paper
217a Welding and Joining
218a Miscellaneous

BATTELLE Technical Review ABSTRACTS

March 1957 Volume 6, Number 3

***Asterisks mark items that may be used in the Battelle Library only. None of the unbound materials listed below are available for interlibrary loan.**

AERONAUTICAL ENGINEERING

3275 Experimental Hyperballistics. H. H. Kurzweg and R. E. Wilson. *Aeronautical Engineering Review*, v. 15, Dec. 1956, p. 32-38.

The use of small-scale models, shock tubes, and hypersonic wind tunnels in investigations of hypersonic data.

3276 A Graphical Method for Determining the Aerodynamic and Economic Characteristics of Turboprop Air-Line Transport Systems. Ralph W. Allen. *Aeronautical Engineering Review*, v. 15, Dec. 1956, p. 55-61.

A method is devised to reduce the magnitude of the work and decrease the time required to examine hundreds of possible designs to arrive at the optimum aircraft transport system.

3277* Shear Flow Through a Cascade. W. R. Hawthorne and W. D. Armstrong. *Aeronautical Quarterly*, v. 7, Nov. 1956, p. 247-274.

Measurements on cascades with small spanwise variations induced in the approaching stream confirm the main predictions of theory.

3278* An Energy Approach to Climb Performance Estimation of a Turbo-Jet Transport Aircraft. Ramchandra B. Tamboli. *Aeronautical Quarterly*, v. 7, Nov. 1956, p. 315-336.

Analytical formulas for evaluating the time needed, distance covered, and fuel consumed during climb under various conditions are developed.

3279 Aircraft Propulsion Data Book. 192 p. 1956. General Electric Co. (TL709 G28a)

A pocket size edition containing technical data relating to properties of air, aerodynamics, propulsion systems, materials, fuels, and oils. Also military, General Electric Co., and miscellaneous information.

3280* The Expected Error of a Least-Squares Solution of Location From Direction-Finding Equipment. B. Harkin. *Australian Journal of Applied Science*, v. 7, Dec. 1956, p. 263-272.

Formulas for the error variances and covariances of the coordinate components of an unweighted least-squares solution for the location of a missile simultaneously reported by a number of optical or electronic direction-finding stations.

3281 Control Tools Develop a New Navigational System. D. J. Green. *Control Engineering*, v. 4, Jan. 1957, p. 65-68.

Simple, self-correcting, automatic navigator is based on the principles of statistical processes and information theory.

3282 The Effect of Meteoric Particles an a Satellite. S. F. Singer. *Jet Propulsion*, v. 26, Dec. 1956, p. 1071-1075, 1087, 1090.

Some physical models to allow calculations of the erosion rate.

3283 Experiments on Cone Drag in a Rarefied Air Flow. D. C. Ipsen. *Jet Propulsion*, v. 26, Dec. 1956, p. 1076-1077.

Experimental drag curves are in fair agreement with available boundary layer predictions if certain induced pressure and tranverse curvature effects are included, although some difference in trend of the experimental and theoretical curves is evident.

3284* Recent Developments in the Theory of Wing-Body Wave Drag. Harvard Lomax and Max A. Heaslet. *Journal of the Aeronautical Sciences*, v. 23, Dec. 1956, p. 1061-1074.

Theoretical analysis of wave drag on airplanes flying at supersonic speeds in the light of the recent discovery of the transonic area rule.

3285* Spectral Theory of Buffeting and Gust Response: Unification and Extension. H. S. Ribner. *Journal of the Aeronautical Sciences*, v. 23, Dec. 1956, p. 1075-1077, 1118.

An extension of the statistical approach to the dynamic response of aircraft in turbulent air.

3286* Some Integrated Volume Properties in Linearized Flow and Their Connection With Drag Reduction at Supersonic Speeds. Z. O. Bleviss. *Journal of the Aeronautical Sciences*, v. 23, Dec. 1956, p. 1078-1080, 1098.

Studies one aspect of the problem of relating the singularity distribution to the body geometry namely, the relationship between the total singularity strength and the total body volume.

3287* Influence of Aerodynamic Heating on the Effective Torsional Stiffness of Thin Wings. Bernard Budiansky and J. Mayers. *Journal of the Aeronautical Sciences*, v. 23, Dec. 1956, p. 1081-1093, 1108.

Theoretical results for the effective torsional stiffness of solid wings of symmetrical double-wedge cross section accelerated to supersonic speeds.

3288* Normal Forces on Flat Plates in Low-Density Supersonic Flow. D. M. Tellep and L. Talbot. *Journal of the Aeronautical Sciences*, v. 23, Dec. 1956, p. 1099-1108.

Normal forces on rectangular flat plates in supersonic, rarefied flow were measured over the range $200 < Re < 2{,}400$ and $3.7 < M < 4.1$ at angles of attack up to 8°.

3289 Reliability in Manufacturing and Design. Robert Lusser. *Military Electronics*, v. 1, Dec. 1956, p. 12-14.

Over-all reliability of guided missiles is always much lower

than that of the least reliable component. Strength and safety factors are considered.

3290* The Moving Aerofoil in the Neighbourhood of a Plane Boundary. D. E. Edmunds. *Quarterly Journal of Mechanics and Applied Mathematics*, v. 9, Dec. 1956, p. 400-424.

Deals with a two-dimensional aerofoil moving in an inviscid, incompressible fluid bounded by a plane wall.

3291* The Effect of Dihedral on the Aerodynamic Derivatives With Respect to Sideslip for Airfoils in Supersonic Flow. J. B. L. Powell. *Quarterly Journal of Mechanics and Applied Mathematics*, v. 9, Dec. 1956, p. 425-440.

3292 Transient Temperature Distributions and Thermal Stresses in Fuselage Shells With Bulkheads or Frames. J. S. Przemieniecki. *Royal Aeronautical Society, Journal*, v. 60, Dec. 1956, p. 799-804.

The temperature distribution and thermal stresses are calculated in a configuration consisting of a cylindrical fuselage shell with bulkheads or frames. At supersonic speeds thermal stresses are set up in a conventional fuselage structure as a result of the bulkhead restraint against circumferential expansion of the fuselage skin.

3293 The Lift Coefficient of a Thin, Jet-Flapped Wing. D. A. Spence. *Royal Society, Proceedings*, v. 238, ser. A, Dec. 4, 1956, p. 46-68.

Accepted methods of thin aerofoil theory are used to obtain a solution for small jet-deflection angles for the case of an infinitely thin jet with finite momentum, and thus infinite velocity.

3294 A Study of the Zero-Lift Drag-Rise Characteristics of Wing-Body Combinations Near the Speed of Sound. Richard T. Whitcomb. *U. S. National Advisory Committee for Aeronautics, Report* 1273, 1956, 22 p. (TL521 Un3r Vis.)

3295 The Motions of Rolling Symmetrical Missiles Referred to a Body-Axis System. Robert L. Nelson. *U. S. National Advisory Committeee for Aeronautics, Technical Note* 3737, Nov. 1956, 51 p. (TL570 Un3t)

Linearized equations of motion are derived and used to establish a technique for the reduction of oscillation data to obtain aerodynamic derivatives.

3296 Theoretical Lift Due to Wing Incidence of Slender Wing-Body-Tail Combinations at Zero Angle of Attack. Alvin H. Sacks. *U. S. National Advisory Committee for Aeronautics, Technical Note* 3796, Nov. 1956, 35 p. (TL570 Un3t)

3297 Drag Interference Between a Pointed Cylindrical Body and Triangular Wings of Various Aspect Ratios at Mach Numbers of 1.50 and 2.02. Elliott Katzen and George E. Kaattari. *U. S. National Advisory Committee for Aeronautics, Technical Note* 3794, Nov. 1956, 41 p. (TL570 Un3t)

3298 Experimental Investigation on the Langley Helicopter Test Tower of Compressibility Effects on a Rotor Having NACA 63_2015 Airfoil Sections. James P. Shivers and Paul J. Carpenter. *U. S. National Advisory Committee for Aeronautics, Technical Note* 3850, Dec. 1956, 28 p. (TL570 Un3t)

Includes data for blade tip Mach numbers from 0.31 to 0.71.

3299 Flight Measurements of the Vibrations Encountered by a Tandem Helicopter and a Method for Measuring the Coupled Response in Flight. John E. Yeates, Jr. *U. S. National Advisory Committee for Aeronautics, Technical Note* 3852, Dec. 1956, 28 p. (TL570 Un3t)

Flight-test and analysis methods for some selected helicopter vibration studies. Use of a mechanical shaker in flight to determine structural response. Natural-vibration measurements of some of the more important harmonics of rotor speed.

3300 Experimental Determination of the Range of Applicability of the Transonic Area Rule for Wings of Triangular Plan Form. William A. Page. *U. S. National Advisory Committee for Aeronautics, Technical Note* 3872, Dec. 1956, 22 p. (TL570 Un3t)

Experimental measurements were made of the zero-lift drag rise at transonic speeds of triangular plan form wings of varying thickness and aspect ratio mounted on a cylindrical body.

3301 Experimental and Predicted Lateral-Directional Dynamic-Response Characteristics of a Large Flexible 35° Swept-Wing Airplane at an Altitude of 35,000 Feet. Stuart C. Brown and Euclid C. Holleman. *U. S. National Advisory Committee for Aeronautics, Technical Note* 3874, Dec. 1956, 74 p. (TL570 Un3t)

Compares frequency responses obtained from transfer-function coefficients calculated for the rigid airplane to indicate the effects of flexibility.

3302 Subsonic Wind-Tunnel Investigation of the Effect of Fuselage Afterbody on Directional Stability of Wing-Fuselage Combinations at High Angles of Attack. Edward C. Polhamus and Kenneth P. Spreeman. *U. S. National Advisory Committee for Aeronautics, Technical Note* 3896, Dec. 1956, 25 p. (TL570 Un3t)

The wings utilized were a 4% thick unswept wing of aspect ratio 3.0 and a 6% thick 45° sweptback wing of aspect ratio 4.

3303 Investigation of the Effectiveness of Boundary-Layer Control by Blowing Over a Combination of Sliding and Plain Flaps in Deflecting a Propeller Slipstream Downward for Vertical Take-Off. Kenneth P. Spreemann and Richard E. Kuhn. *U. S. National Advisory Committee for Aeornautics, Technical Note* 3904, Dec. 1956, 44 p. (TL570 Un3t)

Boundary-layer control is an effective means of maintaining a higher attached flow to flap deflections.

See also: **3740** (air defense computing centers); **3779** (design of electrical airborne equipment); **3824** (vertical scanning air-borne radar); **4142** (design of airframes); **4167** (aircraft structural steel alloy for −100 to 1000 F); **4316** (fatigue crack growth in aircraft); **4537** (operation of airplane fleet).

AGRICULTURE

3304 Effect of Ethylenediaminetetraacetic Acid on Nitrogen Metabolism and Enzyme Patterns in Soybean Plants. L. H. Weinstein, A. M. Meiss, R. L. Uhler, and E. R. Purvis. *Boyce Thompson Institute, Contributions*, v. 18, Oct.-Dec. 1956, p. 357-370.

3305 Fungitoxicity of Substituted *s*-Triazines. Paul H. Schuldt and Calvin N. Wolf. *Boyce Thompson Institute, Contributions*, v. 18, Oct.-Dec. 1956, p. 377-393.

Placement of a halogen or methyl group on the benzene ring of 2,4-dichloro-6-(anilino)-*s*-triazine, as measured by a series of bioassays, resulted in several highly effective triazine fungicides.

3306* Availability of Phosphorus in Soils Pre-Treated With Superphosphate. R. L. Halstead, A. J. MacLean, and L. E. Lutwick. *Canadian Journal of Agricultural Science*, v. 36, Nov.-Dec. 1956, p. 471-482.

Different rates of superphosphate were applied to nearly neutral soil samples of three different types. The soil was kept moist for six weeks, after which alfalfa was grown during a 2 yr. period. In terms of acid-soluble adsorbed, $NaHCO_3$-soluble, and water-soluble P, the recovery per unit of added phosphate generally increased with increasing rates. The average amount of P removed by the top growth for a rate of 200-lb. P_2O_5 per acre exceeded that for the untreated soil by an amount equal to 65% of that added. The corresponding increase for a rate of 2000-lb. P_2O_5 per acre was 31%.

3307* Evaluation of Certain Acaricides and Insecticides for Effectiveness, Residues, and Influence on Crop Flavor. E. Gorton Linsley. *Hilgardia*, v. 26, Aug. 1956, p. 1-106.

3308* (English.) **Experimental Studies on Predation: Predation and Cyclamen-Mite Populations on Strawberries in California.** C. B. Huffaker and C. E. Kennett. *Hilgardia*, v. 26, Oct. 1956, p. 191-222.

Typhlodromus cucumeris and *T. reticulatus* are effective in controlling the cyclamen mite, *Tarsonemus pallidus* banks. Data indicate fairly regular, reciprocally dependtnt oscillations of predator and pest populations, with the pest held to economically unimportant levels.

3309* Determining the Prevalence of Certain Cereal Crop Diseases by Means of Aerial Photography. Robert N. Colwell. *Hilgardia*, v. 26, Nov. 1956, p. 223-286.

Under proper conditions it is possible to recognize healthy wheat, oats, barley, and rye; diseased wheat and oats infested with black stem rust; and diseased oats infested with yellow dwarf virus.

3310 Micronutrients in Crop Vigor. Perry R. Stout. *Journal of Agricultural and Food Chemistry*, v. 4, Dec. 1956, p. 1000-1006.

Recent research has established that Mn, Cu, B, Zn, Mo, and Cl are essential for the growth and development of higher plants.

3311 Mode of Action of Pesticides, Reversal of Fungitoxicity of Copper-8-Quinolinolate. S. S. Block. *Journal of Agricultural and Food Chemistry*, v. 4, Dec. 1956, p. 1042-1046.

Fungitoxicity is reversed in the presence of excess metal ions and excess 8-quinolinol. It appears that the 1 to 1 (moles of 8-quinolinol to Cu) chelate is the toxic entity and that equilibrium and cell penetration relationships account for reversals of antimicrobial action.

3312 Structural Effect of Some Organic Compounds on Soil Organisms and Citrus Seedlings Grown in an Old Citrus Soil. William Moje, J. P. Martin, and R. C. Baines. *Journal of Agricultural and Food Chemistry*, v. 5, Jan. 1957, p. 32-36.

Organisms examined included the citrus nematode, *Tylenchulus semipenetrans* Cobb, fungi, and bacteria. High toxicity to these organisms, and citrus is associated with halides and alcohols containing α,β-unsaturation.

3313 Factors Affecting the Uptake of Phosphorus by Crops in South-East Scotland. K. Simpson. *Journal of the Science of Food and Agriculture*, v. 7, Dec. 1956, p. 745-753.

The apparent recovery of P crops showed highly significant correlations with exchangeable Ca (positive), easily-soluble soil P (negative), and summer rainfall (positive).

3314* Tobacco Mosaic Virus in Orchids in Puerto Rico. J. Enrique Pérez, J. Adsuar, and Orlando Sala. *Phytopathology*, v. 46, Dec. 1956, p. 650-654.

Although tests provided strong evidence of infection of *Cattleya* spp. by tobacco mosaic virus, infection did not appear to be correlated with any particular set of symptoms.

3315* Kinetics of Thermal Destruction of Citrus Tissues in Relation to the Virus Disease Problem. W. C. Price and L. C. Knorr. *Phytopathology*, v. 46, Dec. 1956, p. 657-661.

Thermal destruction of citrus buds was studied by immersing short pieces of stem in a water bath and observing necrosis on or near the bud. Psorosis and tristeza viruses both survived heat treatment as long as the buds survived over the range 35 to 52 C.

3316* The Effect of the Percentage of Seed Transmission Upon Subsequent Spread of Lettuce Mosaic Virus. F. W. Zink, R. G. Grogan, and J. E. Welch. *Phytopathology*, v. 46, Dec. 1956, p. 662-664.

If the percentage of seed transmission exceeds 0.1%, the degree of control is likely to be unsatisfactory.

3317* Comparative Resistance of Seven Pepper Varieties to Five Root-Knot Nematodes. W. W. Hare. *Phytopathology*, v. 46, Dec. 1956, p. 669-672.

3318* Survival of Streptomyces Scabies in Peat Soil Planted With Various Crops. W. J. Hooker. *Phytopathology*, v. 46, Dec. 1956, p. 677-681.

Tests in fallow land and in soils planted with corn, onions, potatoes, and soybeans.

3319* Manganese Content of Peanut Leaves as Related to Soil Factors. C. I. Rich. *Soil Science*, v. 82, Nov. 1956, p. 353-363.

Factors correlating significantly with Mn content are pH, cation-exchange capacity, exchangeable Mn, Ca, Mg, and Na, and easily reducible Mn.

3320* Comparison of Results Obtained by the Balba-Bray Equation and Radioactive Techniques for the Determination of Nutrient Uptake by Plants From Different Nutrient Forms. A. Monem Balba and L. E. Haley. *Soil Science*, v. 82, Nov. 1956, p. 365-368.

3321* Corn Root Penetration in Soils Derived From Various Textures of Wisconsin-Age Glacial Till. J. B. Fehrenbacher and R. H. Rust. *Soil Science*, v. 82, Nov. 1956, p. 369-378.

Differences in the depth of root penetration and in the available soil moisture in the rooting zones are probably the main factors responsible for differences in long-time average corn yields.

3322* Relation of pH to Exchangeable Sodium in Soils as Measured in Dilute Salt Solutions. C. W. Chang, H. E. Dregne, and H. I. Nightingale. *Soil Science*, v. 82, Nov. 1956, p. 387-399.

3323* Influence of Soil Organic Matter on Mineral Uptake by Tomato Plants. H. Nishita, B. W. Kowalewsky, and K. H. Larson. *Soil Science*, v. 82, Nov. 1956, p. 401-407.

Mineral uptake and plant yield were influenced by organic matter concentration, incubation time of the soil, and kind of organic matter.

3324* Effect of Soil Type on Correlation of Soil-Test Values With Crop Response. M. F. Baumgardner and Stanley A. Barber. *Soil Science*, v. 82, Nov. 1956, p. 409-418.

Both drainage profile number and catena affected regression of soil test values for P, but had little affect on K.

3325* A Study of Ion-Exchange Properties of Silt. A. Karim and A. Islam. *Soil Science*, v. 82, Nov. 1956, p. 433-436.

See also: **3465** (fertilizer analysis); **4661** (plastics in agriculture and horticulture).

BIOCHEMISTRY AND BIOPHYSICS

3326* (English.) **The Acid-Soluble Nucleotides of Wheat Plants.** Rolf Bergkvist. *Acta Chemica Scandinavica*, v. 10, no. 8, 1956, p. 1303-1316.

Analysis and isolation of acid-soluble nucleotides from plant tissue. Identification of the 5'-triphosphates of adenosine, guanosine, uridine, and cytidine and mono- and diphosphates.

3327 Advances in Cancer Research. Jesse P. Greenstein and Alexander Haddow, editors. 416 p. 1956. Academic Press, New York. (RC261 Ad95 Vis.)

Eight reviews of progress in various fields.

3328* The Isolation of Cytidine Diphosphate Glycerol, Cytidine Diphosphate Ribitol and Mannitol l-Phosphate From *Lactobacillus arabinosus*. J. Baddiley, J. G. Buchanan, B. Carss, A. P. Mathias, and A. R. Sanderson. *Biochemical Journal*, v. 64, Dec. 1956, p. 599-603.

Isolation includes gradient-elution chromatography on Dowex-2 resin and adsorption on charcoal.

3329* Enzymic and Chemical Properties of Cytoplasmic Particles From Wheat Roots. E. M. Martin and R. K. Morton. *Biochemical Journal*, v. 64, Dec. 1956, p. 687-693.

3330 Chemical Structures and Dissociation Constants of Amino Acids, Peptides, and Proteins in Relation to Their Reaction Rates With 2,4-Dichloro-6-(*o*-Chloroanilino)-*s*-Triazine. H. P. Burchfield and Eleanor E. Storrs. *Boyce Thompson Institute, Contributions*, v. 18, Oct.-Dec. 1956, p. 395-418.

3331 On the Structure of Agar From *Gelidium Cartilaginium*. A. N. O'Neill and D. K. R. Stewart. *Canadian Journal of Chemistry*, v. 34, Dec. 1956, p. 1700-1703.

Structure is represented as a chain of alternating d-galactose and 3,6-anhydro-l-galactose residues with a half-ester sulfate on about every tenth galactose unit.

3332 The Biogenesis of Alkaloids. XVII. Further Study of the Role of Ornithine in the Biogenesis of Stachydrine. Arthur Morgan and Léo Marion. *Canadian Journal of Chemistry*, v. 34, Dec. 1956, p. 1704-1708.

Ornithine may be the precursor of stachydrine, but the transformation to proline and the methylation to the alkaloid occur at a later stage of growth, possibly at seed formation.

3333* On the Mechanism of the Aerobic Oxidation of d-Xylose and d-Ribose-5-Phosphate by Cell-Free Extracts of Pseudomonas Hydrophila. B. A. Stone and R. M. Hochster. *Canadian Journal of Microbiology*, v. 2, Dec. 1956, p. 623-643.

Under aerobic conditions, cell-free extracts grown on d-Xylose oxidize xylose and R-5-P by identical terminal pathways. Diphosphopyridine nucleotide-linked oxidation is much more vigorous than the equivalent triphosphopyridine nucleotide-linked system. Cyanide, hydrazine sulfate, and iodoacetate are effective inhibitors of DPN-catalyzed oxidations. Sedoheptulose-7-phosphate is a key intermediate in the presence of either substrate or cofactor. The over-all oxidation proceeds via d-glyceraldehyde-3-phosphate reactions when DPN is the coenzyme, and most probably via pentose cycle reactions in the presence of TPN. It is suggested that in the intact cell the two pathways compete with one another for the available substrate materials.

3334* (English.) **Interaction Between Surface Active Agents and Proteins. III. Precipitation Curve of the System Sodium Dodecyl Sulfate-Egg Albumin at Various pH's and the Determination of the Concentration of Protein by Titration Using Surfactant.** Koichiro Aoki, Joji Hori, and Keiko Sakurai. *Chemical Society of Japan, Bulletin*, v. 29, no. 7, Sept. 1956, p. 758-761.

3335* (English.) **Internal Rotation in Amino Acids.** Michiro Hayashi, Takehiko Shimanouchi, and San-ichiro Mizushima. *Chemical Society of Japan, Bulletin*, v. 29, no. 7, Sept. 1956, p. 802-804.

Study of equilibrium angles in amino acids based on the data from X-ray structure analysis.

3336* Bisdiguanides Having Antibacterial Activity. F. L. Rose and G. Swain. *Chemical Society, Journal*, Nov. 1956, p. 4422-4425.

Preparation and properties.

3337 Industrial and Medical Uses of Carbohydrates. M. Stacey. *Chemistry & Industry*, no. 47, Dec. 1, 1956, p. 1398-1408.

Review of trends in use of sugars, cellulose, starches, gums, and other products.

3338* Studies on a Radio-Resistant Micrococcus. I. Isolation, Morphology, Cultural Characteristics, and Resistance to Gamma Radiation. A. W. Anderson, H. C. Nordan, R. F. Cain, Gordon Parrish, and Dennis Duggan. *Food Technology*, v. 10, Dec. 1956, p. 575-578.

3339 Fundamentals of Immunology. William C. Boyd. 3rd Rev. Ed. 776 p. 1956. Interscience Publishers, New York. (QR181 B69f3)

For students, research workers, and practicing physicians. Includes most recent advances in the field.

3340 Handbook of Histology. Karl A. Stiles. 4th Ed. 240 p. 1956. McGraw-Hill, New York. (QM553 St53h)

A concise outline of the microscopic characteristics of human tissues and organs.

3341 Fermentor Design for Small Scale Submerged Fermentation. Waldo C. Friedland, Merlin H. Peterson, and John C. Sylvester. *Industrial and Engineering Chemistry*, v. 48, Dec. 1956, p. 2180-2182.

A versatile 30-l. fermentor makes possible study of a wide range of experimental conditions.

3342 Equipment for Detailed Fermentation Studies. H. A. Nelson, W. D. Maxon, and T. H. Elferdink. *Industrial and Engineering Chemistry*, v. 48, Dec. 1956, p. 2183-2189.

A fermentor small enough for ease and economy of handling, but large enough for complete instrumentation and adequate sampling.

3343 Equipment for Small Scale Fermentations. C. L. Kroll, Stanley Formanek, A. S. Covert, L. A. Cutter, J. M. West, and W. E. Brown. *Industrial and Engineering Chemistry*, v. 48, Dec. 1956, p. 2190-2193.

Design and operating characteristics.

3344 Testing of Filters for Phage Removal. H. L. Sadoff and J. W. Almlof. *Industrial and Engineering Chemistry*, v. 48, Dec. 1956, p. 2199-2203.

Filter mats of borosilicate glass wool effectively removed phage particles tagged with radioactive P from aerosol stream.

3345 Control of Oxygen Uptake in Deep Tank Fermentations. Ping Shu. *Industrial and Engineering Chemistry*, v. 48, Dec. 1956, p. 2204-2208.

A control system based on the analysis and control of O concentration in effluent gas makes it possible to control O utilization automatically to follow a predetermined program. The apparatus offers a direct and simple means for transfering aeration data between different fermentors.

3346 Sulfite Oxidation as a Measure of Aeration Effectiveness. Jerome S. Schultz and Elmer L. Gaden, Jr. *Industrial and Engineering Chemistry*, v. 48, Dec. 1956, p. 2209-2212.

Sulfite oxidation rates offer a reasonably good picture of the behavior of the fermentation system where a highly aerobic non-filamentous organism is propagated in a relatively simple medium.

3347 Effect of Physical Variables on Microbiological Transformation of Steroids. Edward O. Karow and Demetre N. Petsiavas. *Industrial and Engineering Chemistry*, v. 48, Dec. 1956, p. 2213-2217.

3348* (English.) **The Use of Ionizing Radiations for Sterilization and Allied Purposes.** R. S. Hannan. *IVA Tidskrift för Teknisk-Vetenskaplig Forskning*, v. 27, no. 6, 1956, p. 256-267.

Treatment with ionizing radiations is capable of inactivating all types of living organisms and can be effected on an industrial scale. The sphere of application is considerable and ranges from the treatment of medical products, already in practical use, to the treatment of foods, still in an experimental stage.

3349* Ergothioneine in Microorganisms. Donald B. Melville, Dorothy S. Genghof, Edward Inamine, and Vladimir Kovalenko. *Journal of Biological Chemistry*, v. 223, Nov. 1956, p. 9-17.

Ergothioneine is a common constituent of many microbial cells and is synthesized by several fungi but not by bacteria.

3350* The Inhibition of Adenosine Deaminase by 8-Azaguanine in Vitro. Philip Feigelson and J. D. Davidson. *Journal of Biological Chemistry*, v. 223, Nov. 1956, p. 65-73.

3351* Protocatechuic Acid Oxidase of Neurospora. L. Ottey and E. L. Tatum. *Journal of Biological Chemistry*, v. 223, Nov. 1956, p. 307-311.

Evidence that ferrous ion and sulfhydryl groups are integral parts of the oxidizing enzyme which transforms protocatechuic acid to *cis, cis*-β-carboxymuconic acid.

3352* Quantitative Estimation of Lyo- and Desmoenzymes in Tissue Sections With and Without Fixation. Marvin M. Nachlas, William Prinn, and Arnold M. Seligman. *Journal of Biophysical and Biochemical Cytology*, v. 2, no. 5, Sept. 1956, p. 487-502.

3353* Factors Affecting the Production of Chromosome Aberrations by Chemicals. B. A. Kihlman. *Journal of Biophysical and Biochemical Cytology*, v. 2, no. 5, Sept. 1956, p. 543-555.

Influence of temperature, pH, and O tension on the production of chromosome aberrations in *Vicia* root tips by maleic hydrazide, di-(2,3-epoxypropyl) ether, and 8-ethoxycaffeine.

3354 Synthesis and Antimicrobial Activity of Some 5-(1-Methylalkylidene)-2,4-Thiazolidinediones. Frances C. Brown, Charles K. Bradsher, and Scott W. Chilton. *Journal of Organic Chemistry*, v. 21, Nov. 1956, p. 1269-1271.

3355 Non-Newtonian Flow in Concentrated Solutions of Sodium Desoxyribonucleate. Frances E. Helders and John D. Ferry. *Journal of Physical Chemistry*, v. 60, Nov. 1956, p. 1536-1540.

Non-Newtonian viscosities of saltfree solutions were measured by capillary and falling ball methods over the concentration range from 0.19 to 18.3 X 10 g. per ml.

3356 Dynamic Mechanical Properties of Concentrated Solutions of Sodium Desoxyribonucleate. Frances E. Helders, John D. Ferry, Hershel Markovitz, and L. J. Zapas. *Journal of Physical Chemistry*, v. 60, Nov. 1956, p. 1575-1578.

3357* Increasing the Sensitivity of the Local-Lesion Method of Virus Assay. William N. Takahashi. *Phytopathology*, v. 46, Dec. 1956, p. 654-656.

Combined use of carborundum uniformly distributed, phosphate buffer as diluent, and *Nicotiana tabacum* var. Xanthi as a more susceptible host increased sensitivity about 4600-fold.

3358 (English and German.) Progress in the Chemistry of Organic Natural Products. **Fortschritte der Chemie Organischer Naturstoffe.** L. Zechmeister, editor. v. XIII. 624 p. 1956. Springer Verlag, Vienna, Austria. (QD245 F77c Vis.)

Review of infra-red spectra and other properties of gallotannine, glycosides, tropolones, alkaloids (including rauwolfia), and peptides.

3359* Relation of Structural Configuration to Protection Against Ionizing Radiations. C. S. Bachofer and O. L. Hartwig. *Radiation Research*, v. 5, Nov. 1956, p. 528-541.

Compounds of identical composition but differing in mol. configuration give different degrees of protection. Mechanisms of protection are considered.

3360 Chemical Aspects of Enzyme Inhibition. Irwin W. Sizer. *Science*, v. 125, Jan. 1957, p. 54-59.

Use of chemical reagents as enzyme inhibitors. Inhibition mechanism; role in catalysis played by active groups on the protein apoenzyme, coenzyme, or metal components.

3361 Biological Effects of External X and Gamma Radiation. II. *U. S. Atomic Energy Commission*, TID-5220, Aug. 1956, 477 p. (UF767 Un3ti Contin.)

A compilation of 22 papers.

3362 Formation of Radioactive Citrulline During Photosynthetic $C^{14}O_2$-Fixation by Blue-Green Algae. Pekka Linko, O. Holm-Hansen, J. A. Bassham, and M. Calvin. *University of California, Radiation Laboratory (U. S. Atomic Energy Commission)*, UCRL-3504, Aug. 1956, 15 p. (UF767 U3u Contin.)

Nostoc muscorum has the ability to fix C^{14} in citrulline during dark fixation, but at a rate slower than in light.

3363* An Enzyme Produced by a Phage-Host Cell System. I. The Properties of a *Klebsiella* Phage. Bo Han Park. **II. The Properties of the Polysaccharide Depolymerase.** Mark H. Adams and Bo Han Park. *Virology*, v. 2, Dec. 1956, p. 711-736.

Yield of enzyme is affected by genetic constitution of both host cell and phase. It can serve as a chemotherapeutic agent for mice infected with the same strain of bacteria in which the enzyme was produced.

3364* Studies on the Soluble Antigen of Influenza Virus. I. The Release of S Antigen From Elementary Bodies by Treatment With Ether. II. A Comparison of the Effects of Sonic Vibration and Ether Treatment of Elementary Bodies. III. The Decreased Incorporation of S Antigen Into Elementary Bodies of Increasing Incompleteness. Florence S. Lief and Werner Henle. **IV. Fractionation of Elementary Bodies Labeled With Radioactive Phosphorus.** Kurt Paucker, Florence S. Lief, and Werner Henle. *Virology*, v. 2, Dec. 1956, p. 753-810.

See also: **3420** (biological fouling in cooling water systems); **3530** (synthesis of bile acids); **3564** (synthesis of 6-succinoamin-opurine); **3619** (dissociation of calcium glucose 1-phosphate); **3708** (mold growth in paint); **3709** (fungistats for paint); **4738** (toxicity of disinfectants).

CERAMICS AND CONCRETE

3365 Determination of the Elastic Constants of Optical Glasses by an Ultrasonic Method. James M. Barnes and E. A. Hiedemann. *Acoustical Society of America, Journal*, v. 28, Nov. 1956, p. 1218-1221.

The values of the elastic constants of 12 samples of domestic optical glasses and a sample of fused silica were calculated from the results of measurements made on these samples.

3366 Application of Two Ultrasonic Methods to the Determination of the Ratio p/q of the Photoelastic Constants of Optical Glasses. H. F. Gates and E. A. Hiedemann. *Acoustical Society of America, Journal*, v. 28, Nov. 1956, p. 1222-1227.

3367 Initial Thermal Expansion Characteristics of Insulating Refractory Concretes. M. S. Crowley. *American Ceramic Society Bulletin*, v. 35, Dec. 1956, p. 465-468.

Laboratory data obtained by measurements of the changes in length of 6-in. by 1-in. by 1-in. specimens, heated uniformly in a horizontal tube furnace at controlled rates up to 450 F per hr.

3368 Time Rate of Change of Concentration in Continuous Glass Melting Furnaces. John F. G. Hicks. *American Ceramic Society Bulletin*, v. 35, Dec. 1956, p. 469-470.

A method of calculating concentrations at the orifice from those in the fill. Agreement between calculated and measured values was found to be satisfactory.

3369 A Method of Measuring the Alkali Resistance of Glazes and Overglaze Decorations. R. J. Brown and R. L. Cook. *American Ceramic Society Bulletin*, v. 35, Dec. 1956, p. 472-475.

Values of alkali resistance were determined by loss in wt. after 72 hrs. attack with a boiling 10% tetrasodium pyrophosphate solution.

3370 Continuation of an Investigation of Low Temperature Strain Reduction in a Cristobalite-Bearing Porcelain Enamel. William Overton Waldhauer. *American Ceramic Society Bulletin*, v. 35, Dec. 1956, p. 476-479.

The effect of PbO, B_2O_3, and Na_2O on low temperature strain in a cristobalite-bearing enamel was studied by measuring ring movement vs. temperature by the split ring method of strain determination.

3371 Some Physical Properties of High-Density Thorium Dioxide. S. M. Lang and F. P. Knudsen. *American Ceramic Society, Journal*, v. 39, Dec. 1956, p. 415-424.

A mixture of 99½% ThO_2 and ½% CaO, by weight, when hydrostatically pressed at 30,000 lb. psi. and heat-treated for 1 hr. at 1800 C in an oxidizing atmosphere, attained 99% of theoretical density. Particle size, lattice constant, and theoretical and bulk densities were determined at room temperature. Room and elevated temperature properties measured include elastic constants, velocity of sound through the material, modulus of rupture, compressive strength, linear-thermal expansion, impact strength, and Knoop hardness, the most significant result being that the material shows no loss in flexural strength when raised to 1000 C. Measurement of tensile strength values possibly would have shown a similar condition. The thermal-shock resistance is believed to be poorer than that of pure thoria.

3372 Formation of Manganese Ferrite by Solid-State Reaction. H. H. Kedesdy and A. Tauber. *American Ceramic Society, Journal*, v. 39, Dec. 1956, p. 425-431.

The range 1150 to 1250 C is considered the minimum sintering temperature for technical manganese-ferrite bodies. Nitrogen firing with slow cooling is recommended.

3373 Determination of 1600° and 1700° C. Liquidus Lines in $CaO \cdot 2Al_2O_3$ and Al_2O_3 Stability Fields of the System CaO-Al_2O_3-SiO_2. Frederick C. Langenberg and John Chipman. *American Ceramic Society, Journal*, v. 39, Dec. 1956, p. 432-433.

3374 Quartz-Coesite Stability Relations at High Temperatures and Pressures. Gordon J. F. MacDonald. *American Journal of Science*, v. 254, Dec. 1956, p. 713-721.

Samples of amorphous SiO_2 in the form of silicic acid ($SiO_2 \cdot nH_2O$) were subjected to pressures up to 80,000 bars and temperatures from 400 to 800 C. The equation of the curve separating the fields of quartz and coesite is $P = 22.5\ T + 9500$ where P is in bars and T is in degrees C with coesite stable in the high-pressure region.

3375* (German.) Preparation of Graphite Electrodes for Electric Arc Furnaces. **Die Herstellung von Graphitelektroden für Elektrostahlöfen.** Alfred Ragoss. *Archiv für das Eisenhüttenwesen*, v. 27, no. 11, Nov. 1956, p. 681-688.

Properties of electrode graphites including electrical resistance, crushing strength, and thermal conductivity in relation to heating temperature. Production methods.

3376 The Fabrication and Physical Properties of Urania Bodies. W. A. Lambertson and J. H. Handwerk. *Argonne National Laboratory (U. S. Atomic Energy Commission)*, ANL-5053, Feb. 1956, 48 p. (UF767 Un3.1an Contin.)

A review. Specimens were corroded in water, H_2O_2 solutions, and NaK eutectic alloy.

3377* New Glass Dielectrics. W. E. Hauth, Jr. and A. L. Pugh, Jr. *Electrical Manufacturing*, v. 59, Jan. 1957, p. 100-103.

Several new compositions, based primarily on the use of major amounts of TiO_2, appear to show excellent application possibilities by virtue of high dielectric constant, low dissipation factor, and moisture stability. Applications include high-temperature capacitors, high-temperature insulators and capacitors, glass-to-metal seals, and sintered glass shapes.

3378 The Micropore Structure of Artificial Graphite. C. N. Spalaris. *Journal of Physical Chemistry*, v. 60, Nov. 1956, p. 1480-1483.

Changes in surface area, pore size distribution, and density of graphite were studied as a function of oxidation. Binding materials used in manufacture are largely responsible for the majority of the pores present.

3379 Boron Carbide Looks Promising for Nuclear Uses. Charles W. Henson. *Materials & Methods*, v. 44, Dec. 1956, p. 96-98.

Discusses properties that have led to use of both granular and molded B_4C in a number of reactors here and abroad.

3380 Effect of Ceramic Coatings on Creep of Alloys. *National Bureau of Standards, Summary Technical Report* 2065, Dec. 1956, 6 p. (Tl Un3.5s Contin.)

Under some conditions a coating can reduce the creep rate as much as 50%, other conditions show a deleterious effect with a cerium oxide coating on a 80% Ni 20% Cr alloy.

3381* (Russian.) Titanium-Alumina Slags for Manufacture of Refractory Material. **O primenenii titano-glinozemistykh shlakov dlia izgotovleniia ogneuporov.** F. Z. Dolkart. *Ogneupory*, v. 21, no. 7, 1956, p. 300-305.

Chemical composition, thermal properties, and method of application of the above as a refractory additive.

3382 Clay Mineralogy Techniques. A Review. Merrill F. Aukland. *Ohio Division of Geological Survey, Information Circular No.* 20, 1956, 31 p. (QE151 Oh.3.3i Vis.)

Classification and nomenclature of clay and clay minerals; physical properties; origin and occurrence; structural mineralogy.

3383 Gamma Radiation Insensitive Optical Glasses. N. J. Kreidl and J. R. Hensler. *Optical Society of America, Journal*, v. 47, Jan. 1957, p. 73-75.

Optical glasses maintain their transparency under exposures up to 10^8 roentgens Co-60 γ-radiation and are usable at $5X10^8$ roentgens.

3384 "Ferroxplana" Hexagonal Ferromagnetic Iron-Oxide Compounds for Very High Frequencies. G. H. Jonker, H. P. J. Wijn, and P. B. Braun. *Philips Technical Review*, v. 18, no. 6, 1956-1957, p. 145-154.

New groups of soft magnetic materials which may be used at frequencies above 100 mc. per sec. Like ferroxcube and ferroxdure, these materials are prepared by the sintering of metal oxides. The composition and some of the properties of the new materials are discussed.

3385 Observed Dependence of the Low-Temperature Thermal and Electrical Conductivity of Graphite on Temperature, Type, Neutron Irradiation, and Bromination. Alan W. Smith and Ned S. Rasor. *Physical Review*, v. 104, ser. 2, Nov. 15, 1956, p. 885-891.

3386 Brittle Fractures Near Equilibrium. F. C. Roesler. *Physical Society, Proceedings*, v. 69, no. 442B, Oct. 1956, p. 981-992.

Measurements on cone fractures in glass.

3387 Some Conclusions From Quality Control of Concrete. R. Shalon. *Research Council of Israel, Bulletin*, v. 5C, Mar.-June 1956, p. 215-230.

Variability is due to unmeasured quantities of mixing water, fluctuations in grading of aggregates, and variation of aggregate proportions as a result of volume-batching. A revision of the standard specifications which require a minimum cement content is advocated.

3388* (French.) Glass Structure, Heat Treatment and Viscosity. **Structure du verre, traitement thermique et viscosite.** E. Plumat. *Silicates Industriels*, v. 21, no. 11, Nov. 1956, p. 447-457.

A theoretical study of the variation of the viscosity of glass as a function of temperature and structure.

3389* (Russian.) Durability of New Refractory Materials. **Stoikost' novykh ogenuporov.** A. A. Litvakovskii. *Steklo i Keramika*, v. 13, no. 11, Nov. 1956, p. 11-15.

Physical-chemical properties of compositions in the Al_2O_3-SiO_2-ZrO_2 system.

See also: **3504** (sintering of Ge oxide); **4072** (silicone coatings); **4215** (open-hearth roof life); **4225** (preparation of castings for enameling); **4592** (rare earth ferrites); **4635** (ceramic magnets).

CHEMICAL ENGINEERING

3390 The Chemical Equilibrium of the Ammonia Synthesis Reaction at High Temperatures and Extreme Pressures. Leonard J. Winchester and Barnett F. Dodge. *A.I.Ch.E. Journal*, v. 2, Dec. 1956, p. 431-436.

3391 Rate of Rise or Fall of Liquid Drops. Albert J. Klee and Robert E. Treybal. *A.I.Ch.E. Journal*, v. 2, Dec. 1956, p. 444-447.

Measurements of the terminal velocity of rise or fall of liquid drops immersed in another insoluble liquid have led to two correlations of velocities with drop diameters and physical properties, one for each of the two velocity-diameter regions.

3392 Mass Transfer in a Horizontal Liquid-Liquid Extraction Tube. Nelson F. Murphy, John E. Lastovica, and Adam E. Skrzec. *A.I.Ch.E. Journal*, v. 2, Dec. 1956, p. 451-455.

Effect of physical properties and of geometrical and dynamical characteristics of several liquid-liquid extraction systems on the mass transfer coefficients.

3393 Fractionation of Gas Mixtures in a Moving-Bed Adsorber. I. Correlation of Adsorber Performance. William H. Kapfer, Monroe Malow, John Happel, and Charles J. Marsel. *A.I.Ch.E. Journal*, v. 2, Dec. 1956, p. 456-467.

The performance of a pilot-scale moving bed adsorber was analyzed by means of a binary system of methane-acetylene, and a ternary system of methane-CO_2-acetylene, using activated C as the preferential adsorbent. The transfer unit height was independent of feed-gas composition but varied linearly with the ratio of feed gas to C flow. For both adsorption and enriching operations the over-all height values varied from 6.5 in. at 1.39 cu. ft. per lb. C to 36.9 in. at 4.81 cu. ft. per lb. C, measured at 60 F and 1 atmosphere. Individual transfer-unit height was approximately 11 in. for the adsorbed phase and zero for the gas phase, indicating that resistance to mass transfer occurred mostly in the adsorbed phase. Two methods for establishing adsorption equilibria were developed.

3394 Measurements of Bubbles Formed in Boiling Methanol. A. S. Perkins and J. W. Westwater. *A.I.Ch.E. Journal*, v. 2, Dec. 1956, p. 471-476.

The photographic method was used to measure bubble sizes and frequencies for methanol boiling at atmospheric pressure outside a ⅝-in. O. D., steam-heated, horizontal Cu tube. Use of Nusselt's equation for steam condensing inside the tube was found to be satisfactory.

3395 Fluidized-Bed Heat Transfer: A Generalized Dense-Phase Correlation. Chin-Yung Wen and Max Leva. *A.I.Ch.E. Journal*, v. 2, Dec. 1956, p. 482-488.

3396 Diffusion and Reaction in Viscous-Flow Tubular Reactor. F. A. Cleland and R. H. Wilhelm. *A.I.Ch.E. Journal*, v. 2, Dec. 1956, p. 489-497.

3397 Liquid Extraction in an Agitated Vessel. R. H. Overcashier, H. A. Kingsley, Jr., and R. B. Olney. *A.I.Ch.E. Journal*, v. 2, Dec. 1956, p. 529-535.

Influence of type, size, and submergence and rotational speed of the impeller and the degree of baffling, residence time, and phase ratio on efficiency of solute transfer between two immiscible liquids.

3398 Single-Phase Blending of Liquids. E. A. Fox and V. E. Gex. *A.I.Ch.E. Journal*, v. 2, Dec. 1956, p. 539-544.

Calculation of mixing time.

3399 Phase Separation and Mass Transfer in a Liquid-Liquid Cyclone. D. J. Simkin and R. B. Olney. *A.I.Ch.E. Journal*, v. 2, Dec. 1956, p. 545-551.

Phase separation is not strongly influenced by cyclone geometry but is principally a function of underflow-overflow split, feed rate, and mixing intensity for a given feed composition and for liquid viscosities of less than nine centipoises.

3400 Evolution of Gas From Liquids Flowing Through Porous Media. E. B. Hunt, Jr. and V. J. Berry, Jr. *A.I.Ch.E. Journal*, v. 2, Dec. 1956, p. 560-567.

Formation of bubbles is a randon process which can be described by a simple probability distribution function. Rate of pressure decline is the most important factor influencing the total number of bubbles produced during the pressure depletion process.

3401 Correlating Kinetic Data in Reactors. Application to Tertiary Butanol Dehydration. J. H. Black, J. H. Wright, and James Coull. *A.I.Ch.E. Journal*, v. 2, Dec. 1956, p. 572-573.

3402 The Difficultly Extractable Lipides of Cottonseed Meats, Their Composition and Effect on the Refining Characteristics of the Crude Oils. P. H. Eaves, J. J. Spadaro, E. L. D'Aquin, A. J. Crovetto, V. O. Cirino, Mack F. Stansbury, and C. L. Hoffpauir. *American Oil Chemists' Society, Journal*, v. 33, Dec. 1956, p. 639-645.

3403* Calcium Carbonate Stabilization of Lime-Softened Water. Herbert O. Hartung. *American Water Works Association, Journal*, v. 48, Dec. 1956, p. 1523-1541.

Removal of supersaturated hardness by contacting the softened water with a slurry bed of $CaCO_3$ was found feasible, but experience with a 6-mgd. prototype installation showed very high costs due to difficulties of holding $CaCO_3$ particles in suspension.

3404* The Generation of Sulphuric Acid From Pyrite by Pressure Leaching. I. H. Warren. *Australian Journal of Applied Science*, v. 7, Dec. 1956, p. 346-358.

Production rate is principally controlled by temperature, provided the reaction is carried out in a system having a high O transfer rate from gas to liquid.

3405 Blending of Low-Viscosity Liquids With Side-Entering Mixers. J. Y. Oldshue, H. E. Hirschland, and A. T. Gretton. *Chemical Engineering Progress*, v. 52, Nov. 1956, p. 481-484.

A report on the mechanics of the blending operation.

3406 Wisconsin Process System for Recovery of Dilute Oxides of Nitrogen. E. D. Ermenc. *Chemical Engineering Progress*, v. 52, Nov. 1956, p. 488-492.

Method is slightly too expensive for use in the U. S., but may be applicable in some foreign areas.

3407 Ripple Trays—A New Tool for Vapor-Liquid Contacting. M. H. Hutchinson and R. F. Baddour. *Chemical Engineering Progress*, v. 52, Dec. 1956, p. 503-508.

A major advantage is the economy made possible by high capacity and simple construction. Includes data from studies with ethanol-water mixtures in a semiworks unit and from the performance of typical commercial operations.

3408 Multilayer Vessels for High Pressure and Temperature. T. McLean Jasper. *Chemical Engineering Progress*, v. 52, Dec. 1956, p. 521-526.

Pressure vessel design and fabrication, with emphasis on laminar construction.

3409 Critical and Terminal Velocities in Fluidization. P. H. Pinchbeck and F. Popper. *Chemical Engineering Science*, v. 6, Nov. 1956, p. 57-64.

Determinations on spherical and nonspherical particles in N.

3410 Circulation in Liquid Drops. P. H. Calderbank and I. J. O. Korchinski. *Chemical Engineering Science*, v. 6, Nov. 1956, p. 65-78.

Study of the process of material and heat transfer to and from liquid drops moving through another continuous fluid.

3411 Distillation at Minimum Variable Reflux. W. R. van Wijk and P. J. Bruijn. *Chemical Engineering Science*, v. 6, Nov. 1956, p. 79-88.

Minimum heat input in a distillation in which the reflux is variable is calculated.

3412 Boundary Conditions of Flow Reactor. J. F. Wehner and R. H. Wilhelm. *Chemical Engineering Science*, v. 6, Nov. 1956, p. 89-93.

An analysis is presented of the boundary conditions for a steady-state flow reactor with axial diffusion and first order reaction.

3413 Water Treatment for Recirculating Systems. C. W. Drane. *Chemistry & Industry*, no. 46, Nov. 24, 1956, p. 1367-1372.

Problems involved in the use of various types of water and the methods available for their solution.

3414 The Manufacture of Phthalic Anhydride by the Fluidized-Catalyst Method. H. L. Riley. *Chemistry & Industry*, no. 49, Dec. 15, 1956, p. 1464-1468.

3415* (German.) New Methods of Absorbing Hydrogen Sulfide and Recovering Sulfur From Carbon Dioxide. **Neuartige H_2S-Absorption und Schwefelgewinnung aus Kohlensäuregasen.** Wilhelm Guntermann. *Gas- und Wasserfach*, v. 97, Ausgabe Gas, no. 21, Nov. 1956, p. 424-427.

Recovery from volcanic water vapors coming from the earth.

3416* (German.) Preparation of Heavy Water. **Die Herstellung von schwerem Wasser.** Hugo Fellner-Feldegg. *Gas- und Wasserfach*, v. 97, Ausgabe Wasser, no. 24, Dec. 15, 1956, p. 1017-1019.

Properties, application in nuclear fission and generation of atomic energy, and preparation.

3417 Batch Versus Continuous Processing in Fluidized Nuclear Reactors. Joseph Halperin and R. W. Stoughton. *Industrial and Engineering Chemistry*, v. 48, Dec. 1956, p. 2115-2122.

Studies of intrinsic efficiency of batch and continuous processing in separating the transmutation products.

3418 Recirculation of Cooling Water in Petroleum Refining. A. J. Brandel. *Industrial and Engineering Chemistry*, v. 48, Dec. 1956, p. 2156-2158.

Problems and treatment procedures.

3419 Re-Use of Cooling Water in an Atomic Energy Commission Installation. Archie L. Biladeau. *Industrial and Engineering Chemistry*, v. 48, Dec. 1956, p. 2159-2161.

High-capacity ion exchange resins hold to a minimum the development of radioactivity in the primary coolant stream of a reactor.

3420 Biological Fouling in Recirculating Cooling Water Systems. John J. Maguire. *Industrial and Engineering Chemistry*, v. 48, Dec. 1956, p. 2162-2167.

Chlorine, Br, chlorinated phenols, Cu salts, and quaternary ammonium compounds prevent interference with heat transfer caused by slime and algae in recirculating cooling water systems.

3421* (Italian.) Chromatographic Analysis Applied to Silica-Gel for Enriching the Hydrocarbon Aromatics in Gasoline Fractions. **Applicazione della chromatografia su gel di silice per l'arricchimento di idrocarburi aromatici in frazioni di benzina.** G. Lo Giudice and E. d'Acquarone. *Rivista dei Combustibili*, v. 10, no. 10, Oct. 1956, p. 717-732.

A pilot plant operation on the enrichment of aromatics in gasoline fractions by silica gel absorption.

3422* The Dynamic Behaviour of Processes in Particular for pH Control. H. Kramers. *Society of Instrument Technology, Transactions*, v. 8, Dec. 1956, p. 144-155.

Frequency-response characteristics measured for a few neutralization processes in a perfect mixer show that for rapid liquid-

liquid and gas-liquid reactions the dynamic response of such an operation can be calculated in advance.

3423 Description and Operation of the N-T-U Retort on Colorado Oil Shale. J. R. Ruark, K. L. Berry, and Boyd Guthrie. *U. S. Bureau of Mines, Report of Investigations* 5279, Nov. 1956, 26 p. (TN21 Un3r)

Two 40-ton capacity batch N-T-U retorts were used to investigate process variables of air rate, recycle gas rate, and shale particle size and grade.

See also: **3473** (infra-red analysis in petroleum refining); **3526** (cracking of cumene in fluidized bed); **3646** (ion exchange applications); **3929** (chemical processing costs); **3931** (economics of German chemical industry); **3941** (petrochemical developments); **3953** (dispersion variables); **4054** (re-use of steam condensate); **4181** (corrosion in petroleum refineries); **4545** (refinery management); **4550** (mixing procedures); **4690** (biological oxidation in an oil refinery re-use system).

CHEMISTRY—ANALYTICAL

3424* (English.) **The Separate Determination of Peroxide-Containing Phospholipids and Other Lipoperoxides.** J. Glavind and S. Hartmann. *Acta Chemica Scandinavica*, v. 10, no. 8, 1956, p. 1298-1302.

Methods include precipitation with acetone, adsorption on alumina, thiocyanate procedure, and indophenol procedure.

3425 Theoretical-Plate Concept in Chromatography. Abdel Salam Said. *A.I.Ch.E. Journal*, v. 2, Dec. 1956, p. 477-481.

General elution and deposition equations were derived and applied to special cases of practical interest.

3426* Basic Principles of Gas Partition Chromatography. Charles L. Teitelbaum. *American Perfumer and Aromatics*, v. 68, Dec. 1956, p. 19-21.

Simplicity, ease of operation, scope, and efficiency of the method indicate great potentialities for the essential oil, flavorings, and cosmetic industries. Details of the apparatus are given.

3427 Determination of Small Amounts of Cobalt in Steels and Nickel Alloys by the Isotope Dilution-Anodic Deposition Method. Darnell Salyer and Thomas R. Sweet. *Analytical Chemistry*, v. 29, Jan. 1957, p. 2-4.

Determinations on standard samples. The observed absolute standard deviation varied from 0.005% for a sample known to contain 0.14% Co to 0.025% for a sample known to contain 0.47% Co. The maximum observed absolute error of the mean was 0.02%.

3428 Chronopotentiometric Analysis in Fused Lithium Chloride-Potassium Chloride. H. A. Laitinen and W. S. Ferguson. *Analytical Chemistry*, v. 29, Jan. 1957, p. 4-9.

3429 Thermochemical Titrations — Enthalpy Titrations. Joseph Jordan and T. G. Alleman. *Analytical Chemistry*, v. 29, Jan. 1957, p. 9-13.

A method for the titrimetric determination of heats of reaction.

3430 Liquid Scintillation Counting of Carbon-14-Labeled Organic Nitrocompounds. Samuel Helf and Cecil White. *Analytical Chemistry*, v. 29, Jan. 1957, p. 13-16.

Carbon-14-labeled organic nitro compounds in liquid scintillators exhibit a quenching of scintillation which results in a reduction of counting efficiency. By the use of suitable wave length shifters in the liquid scintillator medium, the quenching effect can be greatly offset and high counting efficiencies obtained.

3431 Photometric Determination of Aliphatic Amines. Herbert M. Hershenson and David N. Hume. *Analytical Chemistry*, v. 29, Jan. 1957, p. 16-19.

3432 Quantitative Determination of Fluorinated Hydrocarbons by Gas Chromatography. W. C. Percival. *Analytical Chemistry*, v. 29, Jan. 1957, p. 20-24.

Data showing the accuracy and reproducibility for several commercial mixtures of Freon compounds. The 95% confidence limits for the average of duplicate determinations is approximately ± 0.5%.

3433 Interpretation of Areas Used for Quantitative Analysis in Gas-Liquid Partition Chromatography. L. C. Browning and J. O. Watts. *Analytical Chemistry*, v. 29, Jan. 1957, p. 24-27.

3434 Quantitative Determination of Reducing Sugars and Sucrose Separated by Paper Chromatography. R. S. Shallenberger and R. G. Moores. *Analytical Chemistry*, v. 29, Jan. 1957, p. 27-29.

3435 Quantitative Chromatographic Procedure for Determining Dextrose in Sugar Mixtures. Emma J. McDonald. *Analytical Chemistry*, v. 29, Jan. 1957, p. 32-34.

Dextrose can be transferred from a paper chromatogram to glass fiber paper and the sugar subsequently determined in the presence of the glass fiber. Results are given for the procedure as applied to the determination of dextrose in honey.

3436 Coprecipitation of Radium With Barium Sulfate. Louis Gordon and Keith Rowley. *Analytical Chemistry*, v. 29, Jan. 1957, p. 34-37.

The technique of precipitation from homogeneous solution was used to determine the nature of coprecipitation of Ra with barium sulfate. The distribution of Ra between the aqueous and solid phases follows the law of Doerner and Hoskins.

3437 Coprecipitation Studies With Ferric Periodate Precipitated From Homogeneous Solution. Louis Gordon and Leonard Ginsburg. *Analytical Chemistry*, v. 29, Jan. 1957, p. 38-46.

A method for the precipitation of ferric periodate from homogeneous solution is described. This compound was used as a carrier in studying the coprecipitation of Al, Y, and Zn. In the case of Al, coprecipitation was negligible until at least 99.9% of the Fe was precipitated. With Y, coprecipitation was again slight until 99.9% of the Fe had been precipitated.

3438 Separation of Iron From Aluminum by Precipitation of Ferric Periodate From Homogeneous Solution. Leonard Ginsburg, Kay Millar, and Louis Gordon. *Analytical Chemistry*, v. 29, Jan. 1957, p. 46-48.

Iron(III) can be quantitatively precipitated from homogeneous solution as the periodate in very dilute nitric or sulfuric acid. It can be separated from Al by the method described, more effectively in nitric than in sulfuric acid.

3439 Spectrophotometric Determination of Aluminum in Titanium and Titanium Alloys. An Aluminon Method. Dilip K. Banerjee. *Analytical Chemistry*, v. 29, Jan. 1957, p. 55-60.

3440 Photometric Determination of Phosphorus as Molybdovanadophosphoric Acid. Odd B. Michelsen. *Analytical Chemistry*, v. 29, Jan. 1957, p. 60-62.

3441 Infrared Spectrophotometric Determination of Impurities Occurring in Alpha-Chlorotoluene (Benzyl Chloride). Stanley K. Freeman. *Analytical Chemistry*, v. 29, Jan. 1957, p. 63-68.

3442 Spectrophotometric Determination of Iridium With Leuco-Crystal Violet. Gilbert H. Ayres and William T. Bolleter. *Analytical Chemistry*, v. 29, Jan. 1957, p. 72-75.

3443 Indirect Flame Photometric Method for Determination of Halides. Oscar Menis, H. P. House, and T. C. Rains. *Analytical Chemistry*, v. 29, Jan. 1957, p. 76-79.

Chloride, bromide, and iodide can be determined by an indirect flame photometric method which is simple, rapid, and of particular value when concentrations are too low for satisfactory determinations by ordinary potentiometric methods. The sample containing halide ion is added to a dilute Ag nitrate solution. After removal of Ag halide by centrifugation, the luminosity due to residual Ag is measured at 328 mμ. From the decrease in luminosity, the halide equivalent to the Ag removed by precipitation is estimated.

3444 Potentiometric Titration of Hydroperoxides and Peracids in Anhydrous Ethylenediamine. A. J. Martin. *Analytical Chemistry*, v. 29, Jan. 1957, p. 79-81.

Peracids, primary and secondary hydroperoxides, and hydrogen peroxide can be titrated potentiometrically as weak acids with sodium amino-ethoxide in anhydrous ethylenediamine. The titration curves can be interpreted qualitatively and quantitatively.

3445 Colorimetric Estimation of Ligands via Effect of Their Cobalt(III) Complexes on Redox Indicators. Jacob S. Hanker, Irwin Master, Louis E. Mattison, and Benjamin Witten. *Analytical Chemistry*, v. 29, Jan. 1957, p. 82-84.

3446 Isotopic Analysis of Tetramethyllead. G. L. Bate, D. S. Miller, and J. L. Kulp. *Analytical Chemistry*, v. 29, Jan. 1957, p. 84-88.

The average reproducibility for duplicate runs is 0.6, 0.4, 0.4, and 0.2% for lead-204, -206, -207, and -208, respectively. Within these limits there is no evidence of fractionation or contamination during chemical preparation.

3447 Determination of Copper in Fuel Oil and Other Petroleum Products. David M. Zall, Ruth E. McMichael, and D. W. Fisher. *Analytical Chemistry*, v. 29, Jan. 1957, p. 88-90.

An accurate and simple spectrophotometric method for the determination of Cu in petroleum products uses neocuproine (2,9-dimethyl-1,10-phenanthroline) for the development of the Cu-neocuproine complex, which has a maximum absorbance at 450 mμ.

3448* A Fully Automatic Self-Recording and Self-Integrating High-Precision Strip Photometer. H. K. Oosterhuis, G. Prins, and D. Verbeek. *Applied Scientific Research*, v. 6, sec. B, no. 3, 1956, p. 180-188.

A device designed to analyze paper strips as obtained by electrophoresis on filter paper.

3449 The X-Ray Spectrometric Determination of Uranium in Solution. D. S. Flikkema, R. P. Larsen, and R. V. Schablaske. *Argonne National Laboratory (U. S. Atomic Energy Commission)*, ANL-5641, Nov. 1956, 9 p. (UF767 Un3.1an Contin.)

A method comparable to spectrophotometric methods in speed, sensitivity, and accuracy.

3450* An Ion-Exchange Reagent for Use in the Chromatography of Large Peptides. J. Feitelson and S. M. Partridge. *Biochemical Journal*, v. 64, Dec. 1956, p. 607-612.

Reagent was tested in relation to isolation of a large acidic peptide from the products of trypsin digestion of the 'B' chain of oxidized insulin.

3451 Determination of Potassium by Means of Tetraphenyl Sodium Borate. H. W. Berkhout and G. H. Jongen. *Henry Brutcher Translation No.* 3836, 7 p. (From *Chemisch Weekblad*, v. 51, Aug. 28, 1955, p. 607-608.) Henry Brutcher, Altadena, Calif.

3452 Spectrographic Determination of Lead in Ferrotitanium. A. Larsson. *Henry Brutcher Translation No.* 3837, 5 p. (From *Jernkontorets Annaler*, v. 137, no. 6, 1953, p. 191-193.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 193, v. 3, Jan. 1954.

3453 Dimethylphenylbenzylammonium Chloride: A Reagent for the Gravimetric Determination of Platinum. D. E. Ryan. *Canadian Journal of Chemistry*, v. 34, Dec. 1956, p. 1683-1686.

Reagent precipitates Pt quantitatively from tetravalent $PtBr_4$ solutions. The compound formed is a stable ammonium type salt, $(C_{18}H_{16}N)_2PtBr_6$, and is used as a weighing form for Pt.

3454* (English.) **Studies on Organic Reagents for the Colorimetric Analysis of Germanium. III. Colorimetric Determination of Germanium With a New Reagent.** Kenjiro Kimura and Masako Asada. *Chemical Society of Japan, Bulletin*, v. 29, no. 7, Sept. 1956, p. 812-815.

Dimethylaminophenylfluorone forms a soluble complex with Ge in an ethanolic solution containing HCl.

3455* (English.) **Spectrophotometric Determination of Beryllium With Eriochrome Cyanine R.** Shunji Umemoto. *Chemical Society of Japan, Bulletin*, v. 29, no. 8, Nov. 1956, p. 845-852.

Background for choice of reagent is described.

3456* Ionophoresis of Carbohydrates. IV. Separations of Carbohydrates on Fibreglass Sheets. E. J. Bourne, A. B. Foster, and P. M. Grant. *Chemical Society, Journal*, Nov. 1956, p. 4311-4314.

3457* (French.) Spectrophotometric Determination of Phosphorus in Cast Iron. **Dosage spectrophotométrique du phosphore dans les fontes.** L. Braicovich and M. F. Landi. *Fonderie*, no. 129, Oct. 1956, p. 381-388.

A method using the 380 μ wave length permitted the determination of P in cast iron or in carburized ferro-manganese with absolute accuracy.

3458 Selective Analytical Hydrogenation of Olefinic Distillates. H. I. Waterman, A. B. R. Weber, and C. Zweekhorst. *Institute of Petroleum, Journal*, v. 42, Dec. 1956, p. 349-354.

The analytical hydrogenation of two kerosene fractions in a rotating autoclave with different catalysts. Selective hydrogenation of the fractions was possible with Mo on active C (100 atmospheres and 300 C) and with Pt on silica-alumina (10 atmospheres and 120 C).

3459 An Introduction to Modern Organic Analysis. Sidney Siggia and Hans J. Stolten. 250 p. 1956. Interscience Publishers, New York. (QD271 Si23i)

Available analytical tools and their fundamental principles, techniques, correlation, and application.

3460* Continuous Analysis of Argon for Traces of Nitrogen. Reagan Houston and Robert E. Latimer. *ISA Journal*, v. 3, Dec. 1956, p. 490-491.

A trace of N impurity is concentrated by a known factor in a continuous distillation column, and then analyzed in a thermal conductivity cell.

3461 The Detection of Micro Quantities of Gelatin. P. Davis. *Journal of Applied Chemistry*, v. 6, Oct. 1956, p. 413-415.

Procedure involves a concentration of the solution by foaming, and detection of the gelatin in the foam by means of a modified Zsigmondy Au sol test.

3462 Infra-Red Analysis of Phosphorus Compounds. D. E. C. Corbridge. *Journal of Applied Chemistry*, v. 6, Oct. 1956, p. 456-465.

Spectra-structure correlations; absorption spectra of salts; quantitative analysis by the pressed disc method.

3463 Qualitative Analysis of Alloys Containing Molybdenum. Leo Lehrman and Paul Schneider. *Journal of Chemical Education*, v. 33, Dec. 1956, p. 621-622.

A semimicro method of qualitative analysis of Mo within the framework of a scheme used for the common metals.

3464* (French.) A New Method for the Determination of Uranium, Radium, Thorium, and Actinium in Fine Radioactive Ore Particles. **Nouvelle méthode de dosage de l'urnaium, du radium, du thorium et de l'actinium dans des particules fines de minerai radioactif.** G. Becquerel. *Journal de Physique et le Radium*, v. 17, no. 11, Nov. 1956, p. 137A-142A.

Study of absorption of α-rays through the air and application of results to examination of the second growth curve of the reactive deposits in the sample after prolonged heating at 800 C. The ore studied emitted one α-particle per sec.

3465 Recent Advances in the Determination of Phosphate in Fertilizers. R. Donald, E. W. Schwehr, and H. N. Wilson. *Journal of the Science of Food and Agriculture*, v. 7, Nov. 1956, p. 677-691.

3466 An Automatic Analyser of Uranium Content in Process Streams. H. Bisby, L. H. Brown, and D. R. Chapman. *Journal of Scientific Instruments*, v. 33, Dec. 1956, p. 467-475.

Contemporary batch samples are taken in cyclic order from process streams, separately treated with aqueous ammonium thiocyanate, and the resulting color complexes are analyzed by an ultra-violet absorptiometer at 3650 A.

3467* (Hungarian.) Determination of the Manganese and Aluminum Content of Ferrovanadium. **Ferrovanádium mangán- és alumíniumtartalmának meghatározása.** Jenõ Plank. *Kohászati Lapok*, v. 11, no. 9, Sept. 1956, p. 428-429.

Rapid and reliable determination by means of cupferron.

3468 Separation and Determination of Tantalum in Uranium. Glenn R. Waterbury and Clark E. Bricker. *Los Alamos Scientific Laboratory (U. S. Atomic Energy Commission)*, LA-2045, Apr. 1956, 41 p. (UF767 U3La Contin.)

Determination is accomplished by extracting the Ta into hexone from a 6 M. H_2SO_4-0.4M. HF solution and estimating the Ta in the extract colorimetrically.

3469 The Gravimetric Determination of Niobium in Uranium-Niobium Alloys. Owen H. Kriege. *Los Alamos Scientific Laboratory (U. S. Atomic Energy Commission)*, LA-2049, May 1956, 14 p. (UF767 U3La Contin.)

Determination is based on the precipitation of hydrated niobic oxide from a sulfurous acid solution.

3470* (German.) Volumetric Analysis of Titanium. **Zur Massanalyse des Titans. II.** P. Wehber, W. Johannsen, and M. Heydecke. *Metall*, v. 10, nos. 17-18, Sept. 1956, p. 828-833.

Method of Ti determination based on Redox potentials. Simultaneous quantitative analyses of Fe and Ti.

3471 Study in Activation Analysis. W. A. Brooksbank, Jr. *Oak Ridge National Laboratory (U. S. Atomic Energy Commission)*, ORNL-2226, Dec. 1956, 66 p. (UF767 U3o Contin.)

Neutron activation analysis was applied to the determination of Cu, Mn, Ni, Fe, Zn, and Ti in Al alloys. Accuracy and precision of these analyses were ascertained by statistical treatment.

3472 Organic Analysis. John Mitchell, Jr., I. M. Kolthoff, E. S. Proskauer, and A. Weissberger. v. III. 546 p. 1956. Interscience Publishers, New York. (QD271 Or3)

Includes chapters on analytical mass spectrometry and other methods for determination of organic resins, acids, amines and amides, acid anhydrides, and olefinic unsaturation.

3473* Infra-Red Absorption Analysis in the Petroleum Industry. III. The Applications of Infra-Red Analysis. R. Quarendon. *Petroleum*, v. 19, Dec. 1956, p. 439-442.

3474 Determination of Free Acid in the Presence of Hydrolyzable Ions. Glenn L. Booman, Maxine C. Elliott, Robert B. Kimball, Fred O. Cartan, and James E. Rein. *Phillips Petroleum Co., Idaho Operations Office (U. S. Atomic Energy Commission)*, IDO-14387, Sept. 1956, 12 p. (UF767 Un3.1id Contin.)

A simple method using K oxalate as a complexing agent.

3475 Polarographic Determination of Trace Elements in Manganese Metal and Salt Solutions. I. Simultaneous Determination of Traces of Copper, Cadmium, Nickel and Zinc. Y. Israel. *Research Council of Israel, Bulletin*, v. 5C, Mar.-June 1956, p. 171-177.

3476* (French.) A Contribution to the Study of the Analytical Behavior of Nitrides in Steels. **Contribution a l'étude du comportement analytique des nitrures dans les aciers.** P. Tyou, J. Vanstiphout, and M. Lacomble. *Revue Universelle des Mines*, v. 12, ser. 9, no. 12, Dec. 1956, p. 641-652.

A literature survey presents the properties of Al, Si, and Ti nitrides, and methods of characterization of the molecular forms of insoluble N residues.

3477 A Colorimetric Method for Determining Dissolved Oxygen. Charles S. Oulman and E. Robert Baumann. *Sewage and Industrial Wastes*, v. 28, Dec. 1956, p. 1461-1465.

A spectrophotometer was calibrated for colorimetric determination of the I released in the Winkler Method for determining dissolved O in water and sewage. Results closely checked values obtained by titration.

3478* A New Colorimetric Reagent for Micro Determination of Ammonia. W. E. Stone. *Society for Experimental Biology and Medicine, Proceedings*, v. 93, Dec. 1956, p. 589-591.

Ammonia is oxidized by addition of hypobromite, and the excess hypobromite determined by its power to decolorize phenosafranin.

3479* Process Analytical Instrumentation. J. F. Brown and A. G. Stanley. *Society of Instrument Technology, Transactions*, v. 8, Dec. 1956, p. 156-166.

Design factors; specific analytical techniques.

3480* (English.) **The Spectrographic Determination of Oxygen in Metals. I. Plain Carbon Steels.** Velmer A. Fassel and Raymond W. Tabeling. *Spectrochimica Acta*, v. 8, nos. 4-5, Nov. 1956, p. 201-217 + 1 plate.

Description of a d.c. carbon-arc excitation method for determinations in the range of 20 to 2000 p.p.m.

3481 Ethylenediaminetetraacetate Separation of Calcium From Uranium for Flame Photometric Analysis. J. H. Stewart, Jr. and R. C. McIlhenny. *Union Carbide Nuclear Company (U. S. Atomic Energy Commission)*, Y-1140, Aug. 1956, 14 p. (UF767 Un3.1y Contin.)

Accuracy and precision are superior to that obtained by spectrographic analysis.

3482 Serum Lipide Analysis by Chromatography and Infrared Spectrophotometry. Norman K. Freeman, Frank T. Lindgren, Yook C. Ng, and Alex V. Nichols. *University of California, Radiation Laboratory (U. S. Atomic Energy Commission)*, UCRL-3500, Aug. 1956, 24 p. (UF767 U3u Contin.)

The extracted lipides are separated into three fractions by successive elutions from a silicic acid Celite column.

3483 The Development and Evaluation of Radiochemical Separation Procedures for Barium, Calcium, Strontium, Silver and Indium. Duane N. Sunderman. *University of Michigan (U. S. Atomic Energy Commission)*, AECU-3159, Feb. 1956, 197 p. (UF767 U3au Contin.)

Steps which are found unique and possessing general applicability are studied experimentally to determine optimum conditions for separation.

3484* (German.) Ascorbinometric Determination of Zinc and Lead Ions. **Ascorbinometrische Bestimmung von Zink- und Blei-Ionen.** Ladislaus Erdey and Ladislaus Pólos. *Zeitschrift für Analytische Chemie*, v. 153, no. 6, 1956, p. 401-411.

Volumetric determination by means of excess of potassium hexacyanoferrate(II) ions and titrated with 0.1 *N* ascorbic acid.

3485* (Russian.) Dialkyl- and Diaryldithiophosphoric Acids as Analytical Reagents. **Dialkil- i diarilditiofosfornye kisloty kak analiticheskie reaktivy. I.** Potentiometric Copper Determination by Means of Nickel Diethyldithiophosphate. **Potentsiometricheskoe opredelenie medi pri pomoshchi dietildiofosfata nikelia.** A. I. Bussev and M. I. Ivaniutin. *Zhurnal Analiticheskoi Khimii*, v. 11, no. 5, Sept.-Oct. 1956, p. 523-528.

3486* (Russian.) Development of Methods for Chromatographic Separation of Radioisotopes of the Yttrium Group Elements Obtained in Ytterbium and Hafnium Fission by High Energy Protons. **Khromatograficheskoe rasdelenie radioizotopov elementov ittrievoi gruppy, poluchennykh pri rasshcheplenii itterbiia i gafniia protonami vysokoi energii.** A. A. Pozdniakov. *Zhurnal Analiticheskoi Khimii*, v. 11, no. 5, Sept.-Oct. 1956, p. 566-571.

See also: **3326** (analysis of plant tissue); **3512** (Ti salicylate as analytical reagent); **3557** (infra-red analyzer for CO determination); **3671** (analysis of carbon blacks); **3986** (analysis of edible fats); **3991** (analysis of cresols); **4206** (separation of Cb and Ta); **4609** (spectrophotometric errors); **4687** (continuous gas chromatograph for sludge digestion study).

CHEMISTRY—INORGANIC AND GENERAL

3487* (English.) **The Crystal Structure of Indium Oxide Chloride and Indium Oxide Bromide.** Hans-Erik Forsberg. *Acta Chemica Scandinavica*, v. 10, no. 8, 1956, p. 1287-1297.

3488* (English.) **Studies on the Hydrolysis of Metal Ions. XVIII. The Scandium Ion, Sc^{3+}.** George Biedermann, Martin Kilpatrick, Lewis Pokras, and Lars Gunnar Sillén. *Acta Chemica Scandinavica*, v. 10, no. 8, 1956, p. 1327-1339.

Theoretical calculations and comparison with experimental data.

3489 The Crystal Structure of $Ce(IO_3)_4$. Don T. Cromer and Allen C. Larson. *Acta Crystallographica*, v. 9, pt. 12, Dec. 1956, p. 1015-1018.

3490 Crystalline Zeolites. I. The Properties of a New Synthetic Zeolite, Type A. D. W. Breck, W. G. Eversole, R. M. Milton, T. B. Reed, and T. L. Thomas. *American Chemical Society, Journal*, v. 78, Dec. 5, 1956, p. 5963-5977.

Properties and structure of a hydrated crystalline sodium aluminosilicate.

3491 The Anhydrous Reduced Halides of Zirconium and Hafnium. Edwin M. Larsen and James J. Leddy. *American Chemical Society, Journal*, v. 78, Dec. 5, 1956, p. 5983-5986.

A study of reactions of the type $M(s) + 3MX_4(g) = 4MX_3(s)$, where M refers to Zr or Hf and X refers to F, Cl, Br, or I.

3492 The Preparation, Crystal Structure and Some Properties of SmN, EuN and YbN. H. A. Eick, N. C. Baenziger, and L. Eyring. *American Chemical Society, Journal*, v. 78, Dec. 5, 1956, p. 5987-5990.

Preparation by direct combination of the metals with N.

3493 The Role of Chemistry in a Nuclear Energy Project. R. Spence. *British Journal of Applied Physics, Supplement No. 5*, 1956, p. 88S-91S.

Raw materials, production of fuel elements and other special reactor materials, chemistry of nuclear reactors, chemical processing of irradiated materials, and disposal and utilization of radioactive wastes.

3494* (English.) **Preparation of Carrier-Free Yttrium-90 by Paper Chromatography.** Toshiyasu Kiba, Shigeru Ohashi, and Satoshi Tada. *Chemical Society of Japan, Bulletin*, v. 29, no. 7, Sept. 1956, p. 745-748.

Separation from Sr^{90} using as solvent a mixture of ethyl alcohol and 10% solution of ammonium thiocyanate.

3495* (English.) **Studies on the Reduction Pocesses of Germanium Dioxide by Hydrogen.** Hideo Baba. *Chemical Society of Japan, Bulletin*, v. 29, no. 7, Sept. 1956, p. 789-793.

The activation energies for crystalline and amorphous GeO_2 were found to be 18.3 kcal. per mol. and 15.2 kcal. per mol. respectively.

3496* (English.) **Reaction of Hydrogen Peroxide With Titanium(IV) at Different pH Values.** Motoshichi Mori, Muraji Shibata, Eishin Kyuno, and Syu Ito. *Chemical Society of Japan, Bulletin*, v. 29, no. 8, Nov. 1956, p. 904-907.

System is studied over the range of pH 0 to 13.

3497* The Identity of the Cubic Present in Films on Iron. D. Eurof Davies and U. R. Evans. *Chemical Society, Journal*, Nov. 1956, p. 4373-4375.

Studies to distinguish members of the series of cubic iron oxides of which Fe_3O_4 and γ-Fe_2O_3 are end members.

3498* Four-, Five-, and Six-Covalent Palladium(II) Complexes With a Di(Tertiary) Arsine. C. M. Harris and R. S. Nyholm. *Chemical Society, Journal*, Nov. 1956, p. 4375-4383.

Preparation and properties.

3499* The Reduction of Carbon Monoxide by Lithium Aluminium Hydride. J. F. Martin, A. J. Neale, and H. S. Turner. *Chemical Society, Journal*, Nov. 1956, p. 4428-4433.

Studied with the aid of deuterium and carbon-14.

3500* The Simple Fluorides of Iridium. Including the New Trifluoride. P. L. Robinson and G. J. Westland. *Chemical Society, Journal*, Nov. 1956, p. 4481-4487.

Isolation of new compounds, including IrF_5SF_4, IrF_5SO_2, $(NO)_2IrF_6$, $(NO_2)_2IrF_6$, $(NO)_2IrF_5$, and $(NO_2)_2IrF_5$. No evidence of the formation of a penta-fluoride has been secured; but the trifluoride, hitherto unknown was prepared and characterized.

3501* The Sulphates and Selenate of Polonium. K. W. Bagnall and J. H. Freeman. *Chemical Society, Journal*, Nov. 1956, p. 4579-4582.

Preparation and properties.

3502* (French.) Synthesis and Identification of Double Oxide of Tantalum and Uranium. **Synthèse et identification d'un oxyde double de tantale et d'uranium.** Madeleine Gasperin. *Comptes Rendus*, v. 243, no. 2, Nov. 12, 1956, p. 1534-1536.

By heating a mixture of UO_2 and Ta_2O_5 the compound $U_2Ta_2O_7$ was obtained which was identified by its X-ray curve. It is cubic, face-centered, with a unit cell A=10.37Å.

3503 Infrared Spectrum and Structure of Perchlorylfluoride. David R. Lide, Jr. and D. E. Mann. *Journal of Chemical Physics*, v. 25, Dec. 1956, p. 1128-1131.

3504 The Preparation of Orthogermanates by Sintering Reactions: Some New Germanates of the Type A_2GeO_4. W. L. W. Ludekens. *Journal of Inorganic and Nuclear Chemistry*, v. 3, Nov. 1956, p. 281-284.

Includes X-ray powder-diffraction data.

3505 The Reaction of Sulphite Ions in Solutions With Persulphate and Pyrosulphate. A. W. H. Aten, Jr., K. P. Louwrier, Ph. Coppens, H. A. Kok, A. M. de Roos, E. Kriek, A. Hillege, L. Vollbracht, and F. Hartog. *Journal of Inorganic and Nuclear Chemistry*, v. 3, Nov. 1956, p. 296-299.

3506 Thiocyanate Complexes of Lead and Thallium in Solution. G. W. Leonard, Maynard E. Smith, and David N. Hume. *Journal of Physical Chemistry*, v. 60, Nov. 1956, p. 1493-1495.

The dependence of the half-wave potentials of Pb and Tl as a function of thiocyanate ion activity in solutions of constant ionic strength.

3507 Stability of Ferrous Hydroxide Precipitates. F. J. Shipko and David L. Douglas. *Journal of Physical Chemistry*, v. 60, Nov. 1956, p. 1519-1523.

Precipitates can be kept indefinitely at temperatures below 100 C if O is excluded, and if the Fe is sufficiently pure. Decomposition results in formation of magnetite and H.

3508 The Solubility of Ferrous Hydroxide and Ferric Hydroxide in Acidic and Basic Media at 25°. K. H. Gayer and Leo Woontner. *Journal of Physical Chemistry*, v. 60, Nov. 1956, p. 1569-1571.

3509 Hydrogen Triiodide. J. A. Magnuson and J. H. Wolfenden. *Journal of Physical Chemistry*, v. 60, Dec. 1956, p. 1665-1666.

Notes from a spectrophotometric investigation of solutions of I and of HI in CCl_4 and their mixtures. Because the molar extinction coefficient of HI_3 is close to that of I, only a rough estimate of the equilibrium constant is possible.

3510* The Preparation of Highly Concentrated Nitrogen-15 by Chemical Exchange. W. Spindel and T. I. Taylor. *New York Academy of Sciences, Transactions*, v. 19, ser. 2, Nov. 1956, p. 3-16.

3511* (German.) Hydrogen Compounds of Heavy Metals. **Wasserstoffverbindungen von Schwermetallen. V.** A Hydrogen Compound of Divalent Iron. **Über eine Wasserstoffverbindung des zweiwertizen Eisens. VI.** A Hydrogen Compound of Trivalent Iron. **Über eine Wasserstoffverbindung des dreiwertigen Eisens.** Brigitte Sarry. *Zeitschrift für Anorganische und Allgemeine Chemie*, v. 288, nos. 1-2, Nov. 1956, p. 41-61.

Anhydrous $FeCl_2$ and $FeCl_3$ reacts with phenyl magnesium bromide giving solid FeH_2 and FeH_3 respectively. Preparation and properties.

3512* (Russian.) Complex Titanium Salicylates. **O kompleksnykh salitsilatakh titana.** B. N. Sudarikov and L. M. Smirnov. *Zhurnal Neorganicheskoi Khimii*, v. 1, no. 10, Oct. 1956, p. 2327-2336.

Investigation of relation between titanium sulfate and salicyllic acid for determination of the titanium salicylate properties as a reagent in determination of tetravalent metals.

CHEMISTRY—ORGANIC

3513* (English.) **Cyclic Compounds From Acetylpyruvic Esters. III. Structure of the Acid $C_{10}H_{10}O_5$.** Endre Berner. *Acta Chemica Scandinavica*, v. 10, no. 8, 1956, p. 1208-1214.

2-Ethyl-5-hydroxy*iso*phthalic acid was found to be identical with the acid $C_{10}H_{10}O_5$ obtained by treatment of the hydrogenated condensation product of methyl acetylpyruvate with $Ba(OH)_2$.

3514* (English.) **Studies on the Interaction of Paraffin Chain Alcohols and Association Colloids. IX. The Solubility of Decanol-1 in Solutions of Sodium Caprate, Laurate and Myristate Above the C.M.C. X. The Solubility of Decanol-1 in Sodium Oleate Solutions Containing Sodium Chloride.** Kaapo Passinen and Per Ekwall. *Acta Chemica Scandinavica*, v. 10, no. 8, 1956, p. 1215-1233.

3515* (English.) **Action of Neutral Sulphite Solution on Carbohydrates at High Temperatures. I. A Sulphocarboxylic Acid Derived From Xylose.** Sven Yllner. *Acta Chemica Scandinavica*, v. 10, no. 8, 1956, p. 1251-1257.

When heated in neutral sulfite solutions at 135 C xylose is rapidly degraded. A dihydroxy-sulfovaleric acid was isolated from the reaction products and degraded to the lactone of β-sulfo-γ-hydroxybutyric acid, which was synthesised by the addition of sulfite to the lactone of γ-hydroxy*iso*crotonic acid.

3516* (English.) **Syntheses of *p*-Dimethylaminobenzyl Alcohol and Esters of Its Methiodide.** Lars-Erik Tammelin. *Acta Chemica Scandinavica*, v. 10, no. 8, 1956, p. 1276-1278.

p-Dimethylaminobenzyl alcohol was synthesized by catalytic hydrogenation of the corresponding aldehyde and methiodides of the alcohol and corresponding esters from acetic-, malonic-, succinic-, glutaric- and adipic acids were prepared.

3517* (English.) **Synthesis and Paper Electrophoresis of the Galactose Monomethyl Ethers.** Hans Bouveng and Bengt Lindberg. *Acta Chemica Scandinavica*, v. 10, no. 8, 1956, p. 1283-1286.

3518 Advances in Carbohydrate Chemistry. Melville L. Wolfrom and R. Stuart Tipson, editors. v. XI. 465 p. 1956. Academic Press, New York. (QD321 A95 Vis.)

Papers include periodate oxidation, the osones, biosynthesis of monosaccharides and their reactions with β-ketonic esters, kojic acid, nucleic acid, branched-chain sugars, and physical chemistry of starch.

3519 Complexes of Biacetyldihydrazone and Pyridinalhydrazones With Iron (II), Cobalt(II) and Nickel (II). R. Carl Stoufer and Daryle H. Busch. *American Chemical Society, Journal*, v. 78, Dec. 5, 1956, p. 6016-6019.

Preparation, characterization, and magnetic moments.

3520 Organic Compounds of Uranium. V. Derivatives of Uranium (V) Alkoxides. R. G. Jones, E. Bindschadler, D. Blume, G. Karmas, G. A. Martin, Jr., J. R. Thirtle, and H. Gilman. *American Chemical Society, Journal*, v. 78, Dec. 5, 1956, p. 6027-6029.

3521 Elimination Reactions in Cyclic Systems. VI. Reaction of Iodide Ion With Cylcic *trans*-Dibromides. Joseph Weinstock, Sheldon N. Lewis, and F. G. Bordwell. *American Chemical Society, Journal*, v. 78, Dec. 5, 1956, p. 6072-6075.

Suggests that debromination rates may be controlled by the rate of adsorption on the Zn surface, or the high reactivity of Zn as compared to I ion minimize the importance of stereochemical factors.

3522 The Preparation and Geometry of *o,o'*-Bridged Biphenyls Containing Sulfur or Selenium in the Bridge. William E. Truce and D. D. Emrick. *American Chemical Society, Journal*, v. 78, Dec. 5, 1956, p. 6130-6137.

3523 A New Molecular Rearrangement. II. Confirmation of Structures and Extension of the Rearrangement Reaction. A. F. McKay, W. G. Hatton, and R. O. Braun. *American Chemical Society, Journal*, v. 78, Dec. 5, 1956, p. 6144, 6147.

3524 The Synthesis of Oxaziranes. William D. Emmons. *American Chemical Society, Journal*, v. 78, Dec. 5, 1956, p. 6208-6209.

Preparation, properties, structure, and yields.

3525 Critical Constants of the Naphthenic Hydrocarbons. George Thodos. *A.I.Ch.E. Journal*, v. 2, Dec. 1956, p. 508-513.

3526 Effect of Fluidization on Catalytic Cumene Dealkylation. J. F. Mathis and C. C. Watson. *A.I.Ch. E. Journal*, v. 2, Dec. 1956, p. 518-524.

A direct experimental comparison of the cracking of cumene in a fluidized bed of silica-alumina catalyst with the same reaction in a fixed bed. Effects of fluidization on kinetics are interpreted in terms of an empirical approach using effectiveness factors and by a simplified mathematical model.

3527 The Aromatization of Linoleic Acid With Palladium Catalyst. Don E. Floyd, R. F. Paschke, D. H. Wheeler, and W. S. Baldwin. *American Oil Chemists' Society, Journal*, v. 33, Dec. 1956, p. 609-614.

3528* A Preliminary Investigation of the Storage Stability of Aldehydes. Alex Post and Katherine L. Locke. *American Perfumer and Aromatics*, v. 68, Dec. 1956, p. 22-26.

Recommended storage conditions are; amber soft glass bottles with double closures or clear soft glass bottles with paraffin cork closures; both in dim light at room temperature.

3529* (French.) An Introduction to a New Study of Calcium Silicyanamide. **Introduction a une nouvelle étude de la silicicyanamide calcique.** Jean Lang. *Annales de Chimie (Paris)*, v. 1, Sept.-Oct. 1956, p. 745-784.

Objective was to prepare calcium silicicyanimide and study its reactions, especially the action of N on calcium monosilicide and of calcium on silicidiimide.

3530* Partial Synthesis of the Two 3α:7α:12α-Trihydroxycoprostanic Acids and of Similar Bile Acids With Extended Side Chains. R. J. Bridgwater. *Biochemical Journal*, v. 64, Dec. 1956, p. 593-599.

3531 The Synthesis of Phyllopyrrole-Dicarboxylic Acid. S. F. MacDonald and K. H. Michl. *Canadian Journal of Chemistry*, v. 34, Dec. 1956, p. 1671-1676.

3532 The Gas Phase Photolysis of Acetic and Propionic Anhydride. P. Ausloos. *Canadian Journal of Chemistry*, v. 34, Dec. 1956, p. 1709-1713.

3533 The Synthesis of the Uroporphyrins II and IV. S. F. MacDonald and K. H. Michl. *Canadian Journal of Chemistry*, v. 34, Dec. 1956, p. 1768-1781.

3534 The Configuration of Glycosidic Linkages in Oligosaccharides. I. Application of Jackson and Hudson's Oxidation Method to Reducing Disaccharides. A. J. Charlson and A. S. Perlin. **II. By Degradation of Reducing Disaccharides to 2-*O*-Glycosyl-Glycerols.** A. J. Charlson, P. A. J. Gorin, and A. S. Perlin. *Canadian Journal of Chemistry*, v. 34, Dec. 1956, p. 1804-1818.

3535 Preparation of Toxicity of Some Alkyl Thiopyrophosphates. R. A. McIvor, G. D. McCarthy, and G. A. Grant. *Canadian Journal of Chemistry*, v. 34, Dec. 1956, p. 1819-1832.

Several methods of synthesis were studied, all yielding only the thiono isomer, there being no evidence for the corresponding P-S-P isomer. None of the compounds is more toxic intravenously than tetraethyl pyrophosphate.

3536* (English.) **Addition of Trichlorosilane to Styrene, 2 Vinylpyridine, Allylcyanide and Octene-1.** Shun'ichi Nozakura. *Chemical Society of Japan, Bulletin*, v. 29, no. 7, Sept. 1956, p. 784-789.

3537* (English.) **Studies on the Synthesis of Metal Complexes. I. Synthesis of an Ammine-Carbonato Series of Cobalt(III) Complexes.** Motoshichi Mori, Muraji Shibata, Eishin Kyuno, and Tomohiko Adachi. **II. Synthesis and Absorption Spectra of Hydrogen Ethylenediaminetetraacetato-Cobaltate(III) and Sodium-Hydrogen Chloro-Ethylenediaminetetraacetato-Cobaltate(III).** Motoshichi Mori, Muraji Shibata, Eishin Kyuno, and Hiroshi Nakajima. *Chemical Society of Japan, Bulletin*, v. 29, no. 8, Nov. 1956, p. 883-890.

3538* Unsaturated Fatty Acids. II. The Synthesis of Linolenic Acid. S. S. Nigam and B. C. L. Weedon. *Chemical Society, Journal*, Nov. 1956, p. 4049-4054.

The first synthetical confirmation of the long-accepted structure of linolenic acid is presented.

3539* The Dimerisation of Mesityl Oxide. A Novel Type of Diene Addition. E. A. Braude, B. F. Gofton, G. Lowe, and E. S. Waight. *Chemical Society, Journal*, Nov. 1956, p. 4054-4060.

Mesityl oxide dimerizes exothermally under the influence of Li, to give 2-acetyl-1:3:3:5-tetramethyl*cyclo*hex-5-en-1-ol besides other products.

3540* Calciferol and Its Relatives. II. An Alternative Synthesis of *trans*-1-2′-*cyclo* Hexylidene-Ethylidene-2-Methylene*cyclo*hexane. B. Lythgoe, S. Trippett, and J. C. Watkins. *Chemical Society, Journal,* Nov. 1956, p. 4060-4065.

The secondary alcohol and the tertiary amine were prepared and their elimination reactions studied.

3541* Synthesis of Cystinol. J. C. Crawhall, D. F. Elliott, and K. C. Hooper. *Chemical Society, Journal,* Nov. 1956, p. 4066-4068.

Cystinol and some derivatives of cysteinol were prepared and their properties examined with a view to their use in the characterization of C-terminal cysteine residues in proteins and peptides.

3542* Researches on Acetylenic Compounds. LII. The Preparation and Anomalous Absorption Spectra of Some *bicyclo* [2:2:1]-Heptane Derivatives. E. R. H. Jones, G. H. Mansfield, and M. C. Whiting. *Chemical Society, Journal,* Nov. 1956, p. 4073-4082.

Diels-Alder reactions between *cyclo*pentadiene and buta-2:3-dienoic and but-2-ynoic acid give unsaturated *bicyclo*heptane derivatives which show some unexpected spectroscopic properties.

3543* Researches on Polyenes. IV. The ω-*p*-Methoxy-Phenyl-Polyene Aldehydes and Their Absorption Spectra. D. Marshall and M. C. Whiting. *Chemical Society, Journal,* Nov. 1956, p. 4082-4088.

A series of ω-*p*-methoxyphenyl-polyene aldehydes (n=1 to 7) was prepared by use of a chain-extension method whereby two ethylenic bonds are added without isolation of intermediates.

3544* Elaboration Products of Eucarvone. J. R. B. Campbell, A. M. Islam, and R. A. Raphael. *Chemical Society, Journal,* Nov. 1956, p. 4096-4103.

Eucarvone was converted into thujic acid. Selenium dioxide oxidizes eucarvone and α-dihydroeucarvone in an unexpected fashion, producing hydroxy-ketones.

3545* Pulcherrimin: A Synthesis of 1:4-Dihydroxy-2:5-Dioxo-Piperazines. A. H. Cook and C. A. Slater. *Chemical Society, Journal,* Nov. 1956, p. 4130-4133.

3546* The Structure of Pulcherrimin. A .H. Cook and C. A. Slater. *Chemical Society, Journal,* Nov. 1956, p. 4133-4135.

Analytical and degradative evidence indicates that pulcherriminic acid is to be formulated as 2:5-di*iso*butyl-3:4-dihydro-4:6-dihydroxy-3-oxopyrazine 1-oxide.

3547* Triterpenoids. XXII. The Constitution and Stereochemistry of Masticadienonic Acid. D. H. R. Barton and E. Seoane. **XXIII. The Nature of Lantadene A.** D. H. R. Barton, P. de Mayo, and J. C. Orr. *Chemical Society, Journal,* Nov. 1956, p. 4150-4157, 4160-4162.

3548* Syntheses in the Quinazolone Series. II. Synthesis of Quino- and Quinzao-Quinazolones. III. The Formation of Quinazo [4,3-b]Quinazol-8-One and 2-*o*-Aminophenyl-quinazol-4-One by the Hydrolysis of 3-4′-Quinazolinyl-quinazol-4-One. T. Stephen and Henry Stephen. *Chemical Society, Journal,* Nov. 1956, p. 4173-4180.

3549* The Synthesis of 3:4- and 5:6-Benzophenanthridines. B. Mills and K. Schofield. *Chemical Society, Journal,* Nov. 1956, p. 4213-4224.

1-*o*-Acylaminoarylnaphthalenes were cyclized to give 5:6-benzophenanthridine and some of its mono- and di-methyl derivatives.

3550* Flavogallol. J. Grimshaw and R. D. Haworth. *Chemical Society, Journal,* Nov. 1956, p. 4225-4232.

Structure and properties.

3551* Organic Sulphur Compounds. I. The Structure of Anthra-9:10-Quinone-1-Sulphenic Acid, Its Derivatives, and Analogues. J. A. Barltrop and K. J. Morgan. *Chemical Society, Journal,* Nov. 1956, p. 4245-4251.

3552* Studies in the Synthesis of Cortisone. XIII. The Epimeric 3β:7-Dihydroxyergost-22-en-11-Ones. XIV. Acetylhydrazones and Azines of Steroidal Ketones. J. Elks and G. H. Phillipps. **XV. Improvements in the Conversion of Hecogenin Into 3β : 12β-Diacetoxy-5α : 25D-Spirostan-11-One and a Study of the Isomeric 11 : 12-Ketols.** J. Elks, G. H. Phillipps, T. Walker, and L. J. Wyman. **XVI. A New Method of Preparing 11-Oxotigogenin.** J. H. Chapman, J. Elks, G. H. Phillipps, and L. J. Wyman. **XVII. The Bromination of Cholestan-3-One.** C. W. P. Crowne, R. M. Evans, G. F. H. Green, and A. G. Long. **XVIII. The Preparation of Cortisone Esters From 4 : 5α-Dihydrocortisone.** R. M. Evans, J. C. Hamlet, J. S. Hunt, P. G. Jones, A. G. Long, J. F. Oughton, L. Stephenson, T. Walker, and B. M. Wilson. *Chemical Society, Journal,* Nov. 1956, p. 4320-4368.

3553* The Decomposition of Arylazotriarylmethanes. G. L. Davies, D. H. Hey, and Gareth H. Williams. *Chemical Society, Journal,* Nov. 1956, p. 4397-4408.

The energies and entropies of activation were measured in a number of solvents.

3554* Studies of Sultones. E. M. Philbin, E. R. Stuart, R. F. Timoney, and T. S. Wheeler. *Chemical Society, Journal,* Nov. 1956, p. 4414-4417.

Sultones are obtained by treatment of *o*-acetylphenyl methane- or toluene-ω-sulphonate with KOH and pyridine.

3555* Polyazanaphthalenes. IV. Further Derivatives of 1:3:5- and 1:3:8-Triazanaphthalene. V. Oakes and H. N. Rydon. *Chemical Society, Journal,* Nov. 1956, p. 4433-4438.

Synthesis and properties.

3556* Reduced Cyclic Compounds. II. The Synthesis of 1-1′-Acetoxyvinyl*cyclo*hexene and Its Reactions With Some Dienophils. M. F. Ansell and G. T. Brooks. *Chemical Society, Journal,* Nov. 1956, p. 4518-4524.

3557* The Reaction Between Aromatic Compounds and Derivatives of Tertiary Acids. VIII. The Use of an Infrared Gas Analyzer for the Quantitative Determination of Carbon Monoxide. IX. Concentration and Environmental Factors Influencing the Elimination of Carbon Monoxide From Pivaloyl Chloride. Michael E. Grundy, Eugene Rothstein, and Wei-HwaHsü. *Chemical Society, Journal,* Nov. 1956, p. 4558-4571.

3558 Radiation as a Tool in the Synthesis of Organic Compounds. E. J. Bourne, M. Stacey, and G. Vaughan. *Chemistry & Industry,* no. 46, Nov. 24, 1956, p. 1372-1376.

Reaction mechanisms; advantages; problems involved.

3559 Commercial Waxes. H. Bennett, editor. 2nd Rev. Ed. 688 p. 1956. Chemical Publishing Co., New York. (TP670 B43c2)

A compilation of data on characteristics, formulation, and industrial use of natural and synthetic waxes.

3560* (Russian.) Condensation of β-Vinyl-Chloride Ketones With Benzene and Its Homologs. **Kondensatsiia β-Khlorvinilketonov s benzolm i ego gomologami.** A. N. Nesmeianov, M. I. Rybinskaia, and N. K. Kochetkov. *Izvestiia Akademii Nauk SSSR, Otdelenie Khimicheskikh Nauk,* no. 10, Oct. 1956, p. 1197-1201.

Study of a new method for the synthesis of the styryl ketones by condensation of β-vinyl-chloride ketones with aromatic hydrocarbons in the presence of $AlCl_3$ and moist HCl. The greatest activation was developed by chloromethyl-β-vinyl-chloride ketone.

3561* (Russian.) The Action of Water on 3,4-*Bis*-(Chloromethyl) -2,5 Dimethyl Thiophene. **O deistvii vody na 3.4-bis-(khlormetil) -2,5-dimetiltiofen.** Ia. L. Gol'dfarb and M. S. Kondakova. *Izvestiia Akademii Nauk SSSR, Otdelenie Khimicheskikh Nauk,* no. 10, Oct. 1956, p. 1208-1214.

By this action a condensation system of 3,4,6,7 *bis* (2,5 dimethyl 3,4 triene)-oxacyclooctane was formed. Among the products of hydrolysis of 3,4 *bis* (chloromethyl) -2,5-ditributylthiophene and 3,4-*bis*-(chloromethyl) 2,5 diethylthiophene compounds, no analogues were found.

3562 Snythesis of Acetic Acid From Methanol and Carbon Monoxide in the Vapour Phase in Presence of Nickel Catalysts at High Pressures. S. K. Bhattacharyya and S. Sourirajan. *Journal of Applied Chemistry,* v. 6, Oct. 1956, p. 442-456.

3563 Formaldehyde Condensations With Phenol and Its Homologues. XVIII. Chromatographic Analysis. S. R. Finn and J. W. James. *Journal of Applied Chemistry,* v. 6, Oct. 1956, p. 466-476 + 4 plates.

Chromatographic separation of intermediates allows a tentative hypothesis to be formed regarding the reaction mechanism.

3564* Synthesis of 6-Succinoaminopurine. Charles E. Carter. *Journal of Biological Chemistry*, v. 223, Nov. 1956, p. 139-146.

A compound chromatographically and spectrophotometrically identified as the aglycone of adenylosuccinic acid was synthesized from 6-chloropurine and aspartic acid and assigned the structure, 6-succinoaminopurine. The reaction appears applicable to several amino acids.

3565 The Effect of Alkyl Groups on 4-Nitro- and 4-Nitroso-Phenols. Wyman R. Vaughan and G. Kirkwood Finch. *Journal of Organic Chemistry*, v. 21, Nov. 1956, p. 1201-1210.

3566 Synthesis of Methyl 6-Phenyl-3-Methyl-3-Azapimelate. C. F. Koelsch and Franklin M. Robinson. *Journal of Organic Chemistry*, v. 21, Nov. 1956, p. 1211-1213.

The N-phenylacetyl derivative of methyl iminodiacetate was subjected to Dieckmann cyclization, and the resulting 2,4-dioxopyrrolidine was partially deoxidized to a lactam. Ring opening by hydrolysis, followed by methylation, gave desired end product.

3567 Sulfochlorination of Organosilicon Compounds. Glenn D. Cooper. *Journal of Organic Chemistry*, v. 21, Nov. 1956, p. 1214-1216.

Those compounds having the chlorosulfonyl group on a C atom attached to Si underwent Si-C bond cleavage in acidic, basic, or neutral solution. Compounds having a sulfonamide group on the A-C atom were readily cleaved in basic solution.

3568 Isomorphous Relations Between Organic Compounds of Sulfur and Selenium. I. Thermal Analysis of the Systems: Dibenzyl Sulfide-Dibenzyl Selenide and *o*-Nitrodiphenyl Sulfide-*o*-Nitrodiphenyl Selenide. Marco A. Cecchini and Ernesto Giesbrecht. *Journal of Organic Chemistry*, v. 21, Nov. 1956, p. 1217-1220.

3569 Reaction of Organometallic Compounds With Diazonium Salts. Synthesis of Arylazoalkanes. David Y. Curtin and Joanne Arnheim Ursprung. *Journal of Organic Chemistry*, v. 21, Nov. 1956, p. 1221-1225.

Alkyl- and aryl-zinc chlorides react with aryldiazonium fluoborates suspended in ether to give unsymmetrical azo compounds. Organo Li, Mg, Cd, and Hg compounds give greatly reduced yields as do attempts to carry out the reaction as a homogeneous reaction in pyridine.

3570 Methoxyphthalic Acid Esters. Charles A. Burkhard and Robert E. Burnett. *Journal of Organic Chemistry*, v. 21, Nov. 1956, p. 1226-1227.

Preparation and properties of the di-*n*-octyl, bis (2-ethylhexyl), and dilauryl esters of 4-methoxyisophthalic acid and the mono- and di-allyl esters of methoxyterephthalic acid.

3571 The Reactions of Terpenes With Thiourea and Acid. II. Preparation, Properties, and Evidence for the Structure of 1 (S), 8(N)-*p*-Methyleneisothiourea, a New Ring System. L. Carroll King, Lee A. Subluskey, and Eric W. Stern. *Journal of Organic Chemistry*, v. 21, Nov. 1956, p. 1232-1236.

3572 3,5-Diiodo-4-Aminophenylalanine: A Nitrogen Analog of Diiodotyrosine. Paul Block, Jr. *Journal of Organic Chemistry*, v. 21, Nov. 1956, p. 1237-1239.

p-Aminophenylalanine and its α-acetylated derivative were iodinated and the positions which the I atoms assumed on the ring were proved by oxidative degradation.

3573 Potential Purine Antagonists. VI. Synthesis of 1-Alkyl- and 1-Aryl-4-Substituted Pyrazolo (3,4-*d*) Pyrimidines. C. C. Cheng and Roland K. Robins. *Journal of Organic Chemistry*, v. 21, Nov. 1956, p. 1240-1256.

3574 Conversion of *meso*-Hydrobenzoin With Arylsulfonyl Chlorides and Base to *trans*-Stilbene Oxide and to 1,1-Diphenyl-2-(*p*-Toluenesulfonyl-oxy) Ethylene. David Y. Curtin and Yngve Gust Hendrickson. *Journal of Organic Chemistry*, v. 21, Nov. 1956, p. 1260-1263.

3575 Synthesis of Some Methyldisilanes Containing Functional Groups. Makoto Kumada, Masaaki Yamaguchi, Yoshihiro Yamamoto, Jun-ichi Nakajima, and Kyo Shiina. *Journal of Organic Chemistry*, v. 21, Nov. 1956, p. 1264-1268.

3576 A Re-Examination of Indian and Loblolly Turpentines. Maurice D. Sutherland and J. W. Wells. *Journal of Organic Chemistry*, v. 21, Nov. 1956, p. 1272-1275.

Additional constituents revealed in *Pinus longifolia* turpentine were α-thujene, myrcene, limonene, and terpinolene. Myrcene, *p*-cymene, limonene, and methyl chavicol were found in *Pinus taeda* turpentine.

3577 A New Synthesis of Kinetin and Its Analogs. Manuel M. Baizer, John R. Clark, Michael Dub, and Athanasios Loter. *Journal of Organic Chemistry*, v. 21, Nov. 1956, p. 1276-1277.

Adenine is acylated by anhydrides of aliphatic, aromatic or heterocyclic carboxylic acids. Amides formed are reduced to corresponding amines. When insolube intermediate complexes are not formed, yields in the reduction step are satisfactory and products are easily purified.

3578 The Action of Some Organometallic Compounds on Thianthrene-5-Oxide. Henry Gilman and Dhairyasheel R. Swayampati. *Journal of Organic Chemistry*, v. 21, Nov. 1956, p. 1278-1282.

Reduction with methyllithium gave 60% yield of thianthrene, while ethyl- and *n*-butyl-magnesium bromide cleaved the sulfoxide to give, upon carbonation, 2-ethylsulfinyl- and 2-*n*-butylsulfinyl-2'-carboxydiphenyl sulfide, respectively.

3579 Carbinolamines Derived From N-Acetyl-9-ω-Bromoacetyl-9,10-Dihydroacridine. Rearrangement of the Halomethyl Ketone. Lewis J. Sargent. *Journal of Organic Chemistry*, v. 21, Nov. 1956, p. 1286-1288.

3580 The Oxidation of 2,6-Di-*tert*-Butyl-4-Methylphenol. G. R. Yohe, J. E. Dunbar, R. L. Pedrotti, F. M. Scheidt, Fred G. H. Lee, and Earle C. Smith. *Journal of Organic Chemistry*, v. 21, Nov. 1956, p. 1289-1292.

Products formed in oxidation with O and NaOH at 100 C include 3,5-di-*tert*-butyl-4-hydroxybenzaldehyde, trimethylacetic acid, an acidic compound $C_{14}H_{22}O_3$, and probably 2,6-di-*tert*-butylbenzoquinone.

3581 Studies in the Hydroxyanthracene Series. I. Some Reactions of 1-Anthrol. S. S. Lele, N. H. Shah, and Suresh Sethna. *Journal of Organic Chemistry*, v. 21, Nov. 1956, p. 1293-1295.

3582 Separation of Organic Solutions by Thermal Diffusion. Harold F. John and Henry E. Bent. *Journal of Physical Chemistry*, v. 60, Nov. 1956, p. 1524-1528.

Thermal diffusion measurements on solutions of aromatic compounds in benzene. Interpretation of results involves the size and configuration of the molecule.

3583 The Reactions of Ethylenimine and N-Methylethylenimine With Atomic Hydrogen and Their Relation to Complexes in Active Nitrogen Reactions. J. W. S. Jamieson and C. A. Winkler. *Journal of Physical Chemistry*, v. 60, Nov. 1956, p. 1542-1545.

Formation of HCN as a main product suggests that the transition state in the reaction of active N with ethylene may be simulated by the ethylenimino radical.

3584 Stability of Copper and Nickel Chelates of Some Phthalic Acid Derivatives. Motoo Yasuda, Keinosuke Suzuki, and Kazuo Yamasaki. *Journal of Physical Chemistry*, v. 60, Dec. 1956, p. 1649-1651.

Stability constants determined by *p*H method; effects of substitution on stability.

3585* (English.) **Preparation and Constitution of a Number of Derivatives of *Meta*-Di-*Tert*butylbenzene.** J. Burgers, W. Van Hartingsveldt, J. Van Keulen, P. E. Verkade, H. Visser, and B. M. Wepster. *Recueil des Travaux Chimiques des Pays-Bas*, v. 75, no. 11, Nov. 1956, p. 1327-1342.

Synthesis of 22 derivatives is described.

3586* (English.) **Syntheses of Polychloro-Compounds With Aluminum Chloride. XV. The Condensation of Chloral With Trichloroethene.** H. J. Prins. *Recueil des Travaux Chimiques des Pays-Bas*, v. 75, no. 11, Nov. 1956, p. 1347-1357.

Leads to the formation of a heptachlorobutanol-2 and 1,1,2,3,3-pentachloropropene-1.

3587* (English.) **Chemistry of Acetylenic Ethers. XVII. The Reactions of Some Ethoxyethynylcarbinols With Mercaptans and Thio-Acids.** J. H. Sperna Weiland and J. F. Arens. **XVIII. Reactions of Ethoxyethynylcarbinols With Amines. XIX. The Reaction of Aldehydes With Ethoxyethynylmagnesium Bromide. XX. Note on the Preparation of Secondary Ethoxyethynylcarbinols.** J. C. W. Postma and J. F. Arens. **XXI. Reactions of 1,1-Diazido-1-Ethoxyethane With Amines.** Y. A. Sinnema and J. F. Arens. **XXII. Reactions of Ethoxyacetylene With Formaldehyde and Amines.** J. F. Arens, D. H. Koerts, and P. Plieger. **XXIII. Some Reactions of Acetylenic Thioethers.** J. F. Arens, H. C. Volger, T. Doornbos, J. Bonnema, J. W. Greidanus, and J. H. Van Den Hende. *Recueil des Travaux Chimiques des Pays-Bas*, v. 75, no. 11, Nov. 1956, p. 1358 + 57 pages.

3588* (English.) **New Musk Odorants. A New Synthesis of Polyalkylindans. II.** S. H. Weber, J. Stofberg, D. B. Spoelstra, and R. J. C. Kleipool. *Recueil des Travaux Chimiques des Pays-Bas*, v. 75, no. 11, Nov. 1956, p. 1433-1444.

It was found that straight chain secondary alcohols yield substituted cymenes, but secondary alcohols containing a tertiary C atom, and tertiary alcohols yield polyalkylindans.

3589* (English.) **The Sterical Structure of Tropinol and Pseudo-Tropinol.** H. C. Beyerman, C. M. Siegmann, F. L. J. Sixma, and J. H. Wisse. *Recueil des Travaux Chimiques des Pays-Bas*, v. 75, no. 11, Nov. 1956, p. 1445-1453.

Measurements made in aqueous dioxan are in complete accordance with other work.

3590* The Crystalline Hydrates of Alcohols and Glycols. H. H. Hatt. *Reviews of Pure and Applied Chemistry*, v. 6, Sept. 1956, p. 153-190.

A review of the literature, restricted to aliphatic and alicyclic compounds.

3591 Technique of Organic Chemistry. v. III. Pt. I. Separation and Purification. Arnold Weissberger, editor. 2nd Rev. Ed. 873 p. 1956. Interscience Publishers, New York. (QD258 W44s2)

Part one of this volume covers diffusion methods, laboratory extraction and countercurrent distribution, crystallization and recrystallization, centrifuging, filtration, solvent removal, evaporation, and drying.

3592* (Polish.) Fluorine Derivatives From Aliphatic and Aromatic Hydrocarbons. **Fluorowe pochodne węglowodorów alifatycznych i aromatycznych.** Urszula Wrzéciono. *Wiadomosci Chemiczne*, v. 10, no. 10, Oct. 1956, p. 525-553.

A study of aliphatic (saturated and unsaturated) and aromatic F substituted hydrocarbons.

3593 Wool Wax. Chemistry and Technology. E. Vernon Truter. 368 p. 1956. Interscience Publishers, New York. (TP676 T77w)

A comprehensive critical review of fleece by-products including occurrence, methods of extraction, refinement, chemical processing, and uses.

3594* (Russian.) Catalytic Reactions in Presence of Metallic Aluminum. **Kataliticheskie reaktsii v prisutstvii metallicheskogo aliuminiia. II.** Alkylation of Benzene With Chlorocyclohexane and Chlorocyclopentane. **Alkilirovanie benzola khlortsiklogeksanom, i khlortsiklopentanom.** M. B. Turova-Poliak and I. R. Davydova. *Zhurnal Obshchei Khimii*, v. 26, no. 10, Oct. 1956, p. 2710-2716.

Yields cyclohexylbenzenes and cyclopentylbenzenes up to 90 and 95% of the chloro-derivative introduced into the reaction.

3595* (Russian.) Alkylation of Benzene by Di-(1-oxy)-Cyclohexylacetylene Monoacetate. **Ob alkilirovanii benzola monoatsetatom di-(1-oksi)-tsiklogeksilatsetilena v prisvtstvii $AlCl_3$.** R. M. Lagidze, N. K. Iremadze, and L. P. Chigogidze. *Zhurnal Obshchei Khimii*, v. 26, no. 10, Oct. 1956, p. 2754-2758.

The possibility of formation of multi-kernal hydrocarbons is shown.

3596* (Russian.) Investigation in the Field of Conjugate Systems. **Issledovaniia v oblasti sopriazhennykh sistem. LXX.** Diene Syntheses With Fluoroprene. **Dienovye sintezy s uchastiem ftoroprena. Pt. III.** Condensation of Fluoroprene With Non-Saturated Dibasic Acid Esters. **Kondenzatsiia ftoroprena s efirami α,β-nepredel'nykh dvykhosnovnykh kislot.** A. A. Petrov and A. V. Tumanova. *Zhurnal Obshchei Khimii*, v. 26, no. 11, Nov. 1956, p. 2995-2997.

Investigation of the condensation of fluoroprene with maleic, fumaric, and acetylene carboxylic acid diethyl esters.

3597* (Russian.) Investigation in the Heterocyclic Chemistry Field. **XXVI. Issledovanie v oblasti khimii geterotsilklov.** New Syntheses of 9-Phenylacridine. **Novye sposoby polucheniia 9-fenilakridina.** P. A. Petiunin and N. G. Panferova. *Zhurnal Obshchei Khimii*, v. 26, no. 11, Nov. 1956, p. 3191-3193.

Syntheses of the above based on diphenylisatoic anhydride and 2-methyl-6,6-diphenyl [benzo-1',2', : 4,5-(1,3-oxazine)].

3598* (Russian.) Tetraacyloxysilanes in Organic Synthesis. **Tetraatsiloksisilany v organicheskom sinteze. VII.** Silicon Anhydrides of Non-Saturated Monobasic Organic Acids in the Synthesis of Non-Saturated Ketones of the Benzene, Thiophene, and Selenophene Series. **Krenmeangidridy nepredel'nykh odnoosnovnykh organicheskikh kislot v sinteze nepredel'nykh ketonov riada benzola, tiofena i selenofena.** Iu. K. Iur'ev, G. B. Eliakov, and I. M. Milshtein. *Zhurnal Obshchei Khimii*, v. 26, no. 11, Nov. 1956, p. 3194-3198.

See also: **4000** (oxidation of hydrocarbons).

CHEMISTRY—PHYSICAL

3599* (English.) **Kinetics of the Base-Catalysed Reaction Between Acetamide and Formaldehyde and the Ionization Constants of Formaldehyde and Hydroxymethylacetamide.** J. Koskikallio. *Acta Chemica Scandinavica*, v. 10, no. 8, 1956, p. 1267-1275.

3600* (English.) **On the "Entropy Effect" in Chelating Processes.** Svend Erick Rasmussen. *Acta Chemica Scandinavica*, v. 10, no. 8, 1956, p. 1279-1282.

Available data on entropies of chelate compounds indicate that an important factor in the so-called "chelate effect" is the difference in number between monodentate and chelate molecules in a chelating reaction. Entropy differences between complex ammonia metal ions and chelate metal ions are relatively small.

3601* (English.) **The Basicity Constant of *p*-Benzoquinone. Comparison of the Quinhydrone Half-Cell With the Hydrogen Half-Cell in $HClO_4$-$NaClO_4$ Ionic Medium.** George Biedermann. *Acta Chemica Scandinavica*, v. 10, no. 8, 1956, p. 1340-1344.

3602* (English.) **Electrode Impedance Measurements on the Cerium(IV)-Cerium (III) Couple in Perchloric Acid Solutions.** Sture Fronaeus. *Acta Chemica Scandinavica*, v. 10, no. 8, 1956, p. 1345-1354.

3603 The Crystal Structure of Magnesium Phosphite Hexahydrate, $MgHPO_3.6H_2O$. D. E. C. Corbridge. *Acta Crystallographica*, v. 9, pt. 12, Dec. 1956, p. 991-994.

Lattice is rhombohedral, with unit-cell dimensions $aR=5.92$ A., $\alpha=96°\ 24'$. The space group is $R3$ and the Mg, P, and H atoms lie on the unique axis. Crystals are isomorphous with those of Mg sulfite hexahydrate, $MgSO_3.6H_2O$, which probably contain an isostructural arrangement.

3604 The Variation of Vibration Amplitudes With Temperature in Some Molecular Crystals. D. W. J. Cruickshank. *Acta Crystallographica*, v. 9, pt. 12, Dec. 1956, p. 1005-1009.

Characteristic lattice frequencies for translational and rotational vibrations, derived from X-ray and Raman studies, are used to predict variation of molecular vibration amplitudes with temperature in benzene, naphthalene, and anthracene.

3605 Studies in the Carbonate-Uranium System. C. A. Blake, C. F. Coleman, K. B. Brown, D. G. Hill, R. S. Lowrie, and J. M. Schmitt. *American Chemical Society, Journal*, v. 78, Dec. 5, 1956, p. 5978-5983.

Phase diagram for system UO_3-Na_2O-CO_3-H_2O at 26 C. Solubilities for UO_2CO_3 in Na_2CO_3 and for $Na_4UO_2(CO_3)_3$ in Na_2CO_3 and other salt solutions as a function of the concentration of co-solute.

3606 Dimerization Reactions in Sunlight. IV. Photodimerization of Thianaphthene-1,1-Dioxide and Its Substituted Derivatives and of 3-Benzylidene-6,7-Benzophthalide. Ahmed Mustafa and Salah Mohamed Abdel Dayem Zayed. *American Chemical Society, Journal*, v. 78, Dec. 5, 1956, p. 6174-6177.

3607 Diffusion and Hot Radical Kinetics in the Photolysis of Liquid Ethyl Iodide. David L. Bunbury, Russell R. Williams, Jr., and William H. Hamill. *American Chemical Society, Journal*, v. 78, Dec. 20, 1956, p. 6228-6233.

A photolysis mechanism is proposed and tested in which the primary act is dissociation of the C-I bond.

3608 Liquid-Side Resistance in Gas Absorption. J. E. Vivian and D. W. Peaceman. *A.I.Ch.E. Journal*, v. 2, Dec. 1956, p. 437-443.

Experiments with short wetted-well columns support Higbie's penetration theory.

3609 Compressibility of Gaseous Propane-Propene Mixtures. Kun Li and Lawrence N. Canjar. *A.I.Ch.E. Journal*, v. 2, Dec. 1956, p. 448-450.

Measurements at 45 F intervals from 212 to 482 F and at pressures from 200 to 3200 psi.a.

3610 Mass Transfer Rates in Ion Exchange. W. A. Selke, Y. Bard, A. D. Pasternak, and S. K. Aditya. *A.I.Ch.E. Journal*, v. 2, Dec. 1956, p. 468-470.

Mass transfer coefficients determined by means of shallow-bed experiments are in accord with the general correlations for packed beds if the Schmidt number is evaluated with the proper diffusivities for the counterflow of ions.

3611 Thermodynamic Properties of Polar-Nonpolar Mixtures: Methanol-Benzene-Hexane System. P. G. McCracken and J. M. Smith. *A.I.Ch.E. Journal*, v. 2, Dec. 1956, p. 498-507.

3612 Thermodynamic Properties of *n*-Hexane. James H. Weber. *A.I.Ch.E. Journal*, v. 2, Dec. 1956, p. 514-517.

3613 Prediction of Vapor-Liquid Equilibrium Data for Binary Hydrocarbon Mixtures at Various Total Pressures. Benjamin C.-Y. Lu. *A.I.Ch.E. Journal*, v. 2, Dec. 1956, p. 525-528.

3614 Thermodynamic Properties of Tertiary Butyl Alcohol. Lester H. Krone, Jr. and R. Curtis Johnson. *A.I.Ch.E. Journal*, v. 2, Dec. 1956, p. 552-554.

3615 Composition Change in Binary-Component Spray Vaporization at Atmospheric Pressure. J. F. Culverwell, P. W. Grounds, Jr., G. G. Lamb, and W. F. Stevens. *A.I.Ch.E. Journal*, v. 2, Dec. 1956, p. 555-560.

Behavior of the system orthodichlorobenzene-tetrachloroethylene was studied in air ranging from 400 to 1,000 F. Rate of change of spray composition was affected only by the chamber-air temperature, the initial feed composition, and the nozzle characteristics.

3616 Kinetics of the Exchange Reaction Between Two Oxidation States of Cerium. Frank R. Parchen, Jr. and F. R. Duke. *Ames Laboratory (U. S. Atomic Energy Commission)*, ISC-671, Mar. 1955, 34 p. (UF767 Un3.1is Contin.)

3617* (French.) Accelerating or Inhibiting Effects of Hydrocarbons and Alcohols in Aqueous Solution on $FeSO_4$ Oxidation by Ionizing Radiations. **Effects Accélérateurs ou inhibiteurs d'hydrocarbures et d'alcools en solution aqueuse sur l'oxydation de $FeSO_4$ par les rayonnements ionisants.** Catherine Vermeil. *Annales de Chimie (Paris)*, v. 1, Sept.-Oct. 1956, p. 641-686.

Alpha and X-ray irradiation of ferrous solutions containing cyclohexane, benzene, or butanol.

3618* (French.) Study of the Thermal Variation of the Magnetic Susceptibilities of Some Organic Crystals. **Étude de la variation thermique des susceptibilités magnétiques de quelques cristaux organiques.** Nicole Lumbroso-Bader. *Annales de Chimie (Paris)*, v. 1, Sept.-Oct. 1956, p. 687-744.

A study of the magnetic anisotropy of a series of aromatic compounds and of the variation of the crystalline susceptibilities with temperature. Values, comparable to those given by theoretical chemistry, of the principal susceptibilities were proposed for the mol. after practical corrections for the effect of thermal oscillation.

3619* Thermodynamic Quantities for the Dissociation Equilibria of Biologically Important Compounds. VI. The Dissociation of Calcium Glucose 1-Phosphate. H. B. Clarke and S. P. Datta. *Biochemical Journal*, v. 64, Dec. 1956, p. 604-606.

Constants have been measured from 10 to 50 C by using H and Ag-AgCl electrodes in cells without liquid junction.

3620 Kinetics of Nucleation in Supersaturated Vapors. I-III. R. Becker and W. Döring. *Henry Brutcher Translation Nos.* 3655, 3656, and 3657, 19, 36, and 50 p. (From *Annalen der Physik*, v. 24, 1935, p. 719-752.) Henry Brutcher, Altadena, Calif.

3621 The Heat of Neutralization of Strong Acids and Bases in Highly Dilute Aqueous Solutions. H. M. Papee, W. J. Canady, and K. J. Laidler. *Canadian Journal of Chemistry*, v. 34, Dec. 1956, p. 1677-1682.

Data on neutralization of H_2SO_4 and HCl by NaOH.

3622 Measurement of Pressures in the Titanium Iodine System Using the Effusion Method. A. Herczog and L. M. Pidgeon. *Canadian Journal of Chemistry*, v. 34, Dec. 1956, p. 1687-1692.

The equilibrium vapor pressures of TiI_4 and TiI_2, obtained by the simultaneous decomposition and evaporation of TiI_3 in the presence of excess Ti, were measured over the temperature range 750 to 902 K using the effusion method.

3623 The Adsorption of Nitrogen by Brominated Charcoal. H. L. McDermot. *Canadian Journal of Chemistry*, v. 34, Dec. 1956, p. 1693-1699.

Removal of the sorbed Br by heat-treatment did not bring about activation of the charcoal. The density of sorbed Br was found to be less than that of solid Br.

3624 Solvolysis in Deuterium and Hydrogen Oxide. P. M. Laughton and R. E. Robertson. *Canadian Journal of Chemistry*, v. 34, Dec. 1956, p. 1714-1718.

Rate data for a series of benzenesulfonates, halides, and methyl methanesulfonate were determined in light and heavy water.

3625 The Oxidation of Carbon Monoxide by Solid Silver Permanganate Reagents. VI. Reaction Kinetics and Adsorption of Water Vapor. Morris Katz, R. Riberdy, and G. A. Grant. *Canadian Journal of Chemistry*, v. 34, Dec. 1956, p. 1719-1729.

3626 The OH Stretching Frequencies of Some New Alcohols. F. A. L. Anet and P. M. G. Bavin. *Canadian Journal of Chemistry*, v. 34, Dec. 1956, p. 1756-1759.

Frequency shifts from the values observed for simple alcohols are interpreted in terms of H bonding, steric hindrance, and interaction of the OH group with π-electron systems.

3627 The Polarography of the Methyl Derivatives of Maleic Hydrazide and Explanation of the Maleic Hydrazide Waves. D. M. Miller. *Canadian Journal of Chemistry*, v. 34, Dec. 1956, p. 1760-1767.

3628 The Infrared Spectra of Secondary Amines and Their Salts. R. A. Heacock and Leo Marion. *Canadian Journal of Chemistry*, v. 34, Dec. 1956, p. 1782-1795.

Spectra of salts differ from those of corresponding bases in containing several absorption bands that are absent from the latter.

3629 The Raman Spectrum of Acetylene. T. Feldman, G. G. Shepherd, and H. L. Welsh. *Canadian Journal of Physics*, v. 34, Dec. 1956, p. 1425-1430.

Rotational structures. Derivation of band origins, rotational constants, and certain anharmonicity coefficients.

3630 The Raman Spectrum of Dideuteroacetylene. L. Krause and H. L. Welsh. *Canadian Journal of Physics*, v. 34, Dec. 1956, p. 1431-1435.

3631 The Chemical Bond in Semiconductors. The Group V B to VII B Elements and Compounds Formed Between Them. E. Mooser and W. B. Pearson. *Canadian Journal of Physics*, v. 34, Suppl. no. 12A, Dec. 1956, p. 1369-1376.

3632 The Effect of Surface Active Agents on the Rate of Absorption of Carbon Dioxide by Water. E. J. Cullen and J. F. Davidson. *Chemical Engineering Science*, v. 6, Nov. 1956, p. 49-56.

Experimental results are compared with theoretical calculations based on the assumption of equilibrium at the interface, absorption being controlled by diffusion.

3633* (English.) **The Studies on Micelles of Surfactants. I. The Phase in the Interior of Micelles of Surfactants.** Hiroji Sasaki, Haruhiko Okuyama, and Shuji Saito. *Chemical Society of Japan, Bulletin*, v. 29, no. 7, Sept. 1956, p. 752-757.

From the spectral changes of the n, π, and B bands, it is concluded that the surfactant micelle, at least up to 10% concentration, contains some water molecules.

3634* (English.) **Exchange Reaction Between Deuterium and Ammonia on Synthetic Ammonia Catalysts Promoted Singly, Doubly, and Triply.** Hiroshi Uchida and Naoyuki Todo. *Chemical Society of Japan, Bulletin*, v. 29, no. 7, Sept. 1956, p. 762-767.

Determination of the rate in the exchange reaction on three catalysts promoted by alumina with or without potash or potash and lime.

3635* (English.) **Magnetic Susceptibilities of Coronene, Pentacene and Related Compounds.** Hideo Akamatu and Yoshio Matsunaga. *Chemical Society of Japan, Bulletin*, v. 29, no. 7, Sept. 1956, p. 800-802.

3636* (English.) **Study on the Molecular Structure of Bisacetylacetone-Copper(II) by Electron Diffraction.** Shuzo Shibata and Kōzō Sone. *Chemical Society of Japan, Bulletin*, v. 29, no. 8, Nov. 1956, p. 852-856.

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3637* The Polarography of Oximes. H. J. Gardner and W. P. Georgans. *Chemical Society, Journal*, Nov. 1956, p. 4180-4186.

The polarographic behavior of some alkyl aryl and diaryl ketoximes was studied in buffered solutions.

3638* Electronic Spectra of Organic Molecules and Their Interpretation. II. Effect of Terminal Halogen Atoms of Conjugated Systems on K-Bands. A. Burawoy and A. R. Thompson. *Chemical Society, Journal*, Nov. 1956, p. 4314-4320.

The *K*-bands are displaced to longer wavelengths with increasing polarizability of the C-Hal electrons. The effective electron migration of the *K*-band transition in iodobenzene and other compounds is determined by the terminal iodo and other constituents, and is directed toward the halogen atom.

3639* The Chemical Action of Ultrasonic Waves. A. V. M. Parke and Duncan Taylor. *Chemical Society, Journal*, Nov. 1956, p. 4442-4450.

Spectra of the sonoluminescence from aerated Br water and from aerated aqueous CS_2 solution were examined. Oxidation of KI solutions increased linearly with time of irradiation. In the O_2-KI-H_2O solutions a three-fold increase in the rate of liberation of I occurred without change in luminescence when the pH was reduced from about 7 to 2.

3640* The Electrical Conductances of Solutions in Nitric Acid. I. Solutions of Dinitrogen Pentoxide, and of Water. The Extent of the Self-Dissociation of Nitric Acid. W. H. Lee and D. J. Millen. *Chemical Society, Journal*, Nov. 1956, p. 4463-4469.

3641* Infrared Spectra of Metal Ammines and Related Compounds. II. The *Trans*-Effect in Platinous Complexes. D. B. Powell. *Chemical Society, Journal*, Nov. 1956, p. 4495-4498.

3642 The Relation Between Configuration and Conjugation in Diphenyl Derivatives. VII. Halogenodiphenyls. G. H. Beaven and D. Muriel Hall. *Chemical Society, Journal*, Nov. 1956, p. 4637-4646.

3643* The Reaction of Tetra-Alkylammonium Halides With Potassium in Liquid Ammonia. D. A. Hazlehurst, A. K. Holliday, and G. Pass. *Chemical Society, Journal*, Nov. 1956, p. 4653-4658.

The cation of a tetra-alkylammonium salt NR_4X undergoes N-C bond fission with K in liquid ammonia, giving a hydrocarbon RH and an amine NR_3. With a tetramethylammonium salt the yield of methane decreases in the order X=Cl,Br,I, and C-H fission may occur to yield H and ethylene.

3644 Cathodic Reduction of 3,4,5,6-Tetrachloro-*N*-(2-Dimethylaminoethyl)-Phthalimide in an Aqueous Medium at a Lead Cathode. M. J. Allen and J. Ocampo. *Electrochemical Society, Journal*, v. 103, Dec. 1956, p. 682-683.

3645* (German.) Ion Exchangers as High Disperse Systems and Their Action on Colloidal Substances. **Ionenaustauscher als hochdisperse Systeme und ihre Wirkung auf kolloide Stoffe.** R. Griessbach and A. Richter. *Grenzflächenprobleme und Reaktionen im kolloiden Zustand*, Suppl. no. 17; *Kolloid-Zeitschrift*, v. 146, 1956, p. 107-120. (QD549 En19g)

The use of ion exchangers has made possible the division of substances whose dimensions put them between the molecular and the colloidal forms. Examples of colloidal reactions.

3646 Ion Exchange and Its Applications. 173 p. 1955. Society of Chemical Industry, London. (TP156. I6 So13i Over.)

Twenty papers on various aspects of ion exchange.

3647* (Russian.) Successive Reactions of Hydrogenation on a Cyclopentadiene Double Bond on a Nickel Grid Catalyst. **Posledovatelnost' gidrirovaniia dvoinykh sviazei tsiklopentadiena na skeletnom nikelevom katalizatore.** L. X. Freidlin and B. D. Polkovnikov. *Izvestiia Akademii Nauk SSSR, Otdelenie Khimicheskikh Nauk*, no. 10, Oct. 1956, p. 1171-1179.

A study of the kinetics of hydrogenation of cyclopentadiene in the presence of a grid Ni catalyst at 25 C and normal pressure in alcohol and hydrocarbon solutions. In both solutions cyclopentene can be obtained from cyclopentadiene, if the hydrogenation is stopped after the addition of one H mole.

3648* (Russian.) Catalytic Activation and Acidity of Silica Gel Treated With Aluminum Salt Solutions. **Kataliticheskaia aktivnost i kislotnost' silikagelia obrabotannogo rastvorami solei aluminiia.** K. G. Miesserov. *Izvestiia Akademii Nauk SSSR, Otdelenie Khimicheskikh Nauk*, no. 10, Oct. 1956, p. 1180-1184.

The substitution of H ions by Al ions in hydrolytic hydroxyl groups have an activating influence on silica gel. This activation is more effective with basic salts of Al than with Al oxides.

3649 High-Temperature Thermodynamic Properties of Uranium Dioxide. Raymond J. Ackermann, Paul W. Gilles, and R. J. Thorn. *Journal of Chemical Physics*, v. 25, Dec. 1956, p. 1089-1097.

Determination of vapor pressure by the effusion method; volatility of U-UO_2 mixtures; composition of residues and sublimates after appreciable vaporization.

3650 Optical Rotatory Dispersion of Transition-Metal Complexes. William Moffitt. *Journal of Chemical Physics*, v. 25, Dec. 1956, p. 1189-1198.

Electronic factors governing rotational strengths of absorption band systems. Selection rules which may facilitate identification of the systems.

3651 Magnetic Susceptibilities of Uranium (V) and Uranium (III) Chlorides. Paul Handler and Clyde A. Hutchison, Jr. *Journal of Chemical Physics*, v. 25, Dec. 1956, p. 1210-1213.

3652 Structures of Toluene, Phenylsilane, and Diphenyldichlorosilane. F. A. Keidel and S. H. Bauer. *Journal of Chemical Physics*, v. 25, Dec. 1956, p. 1218-1227.

Determinations by means of electron diffraction in the gas phase.

3653 Viscosity and Density of the Liquid System TNT-Picric Acid and Four Related Pure Materials. Donald W. Moore, Lohr A. Burkhardt, and William S. McEwan. *Journal of Chemical Physics*, v. 25, Dec. 1956, p. 1235-1241.

Temperature-dependence of viscosity was found to be represented by a continuous exponential function. Density varied linearly with temperature.

3654 Raman Spectra and Force Constants of GeI_4 and SnI_4. H. Stammreich, Roberto Forneris, and Yara Tavares. *Journal of Chemical Physics*, v. 25, Dec. 1956, p. 1278-1279.

Observed and calculated values are in excellent agreement.

3655* (French.) Speed of Metalloidal Reactions on Metals When the Interfacial Reactions Combine With Diffusion. Application to Silver Sulfurization. **Vitesse de reactions des metalloïdes sur les métaux quand les réactions interfaciales se composent avec la diffusion application a la sulfuration de l'argent.** M. Billy and G. Valensi. *Journal de Chimie Physique*, v. 53, no. 10, Oct. 1956, p. 832-844.

A study of the practical significance, in the diffusion process in β-Ag_2S, of the interfacial reactions in the kinetics of growth of thin layers and of an original method for distinguishing the internal from the external interfacial reaction.

3656 Ionization Potentials and the Chemical Binding and Structure of Simple Inorganic Crystalline Compounds. I. Chemical Binding. II. Crystal Structure. L. H. Ahrens and D. F. C. Morris. *Journal of Inorganic and Nuclear Chemistry*, v. 3, Nov. 1956, p. 263-280.

Variations in the nature of bonding with ionization potentials are correlated with lattice energies, interatomic distances, color, and magnetic, structural, and microwave data. Structures are interpreted in the light of properties of the interacting cations and anions.

3657* The Evaporation and Rehydration of Aqueous Solutions. Walter L. Crider, Richard H. Milburn, and Stephen D. Morton. *Journal of Meteorology*, v. 13, Dec. 1956, p. 540-547.

A quartz-fiber microbalance is used to measure the course of rehydration of NaCl particles at various humidities.

3658 Catalysis by Anion Exchange Resins. Condensations of Nitroparaffins With Aldehydes and Ketones. Melvin J. Astle and Franklin P. Abbott. *Journal of Organic Chemistry*, v. 21, Nov. 1956, p. 1228-1231.

3659 The Negative Activity Limit of Stability and the Coagulation Values of the Silver Halides. M. Mirnik, F. Flajšman, K. F. Schulz, and B. Težak. *Journal of Physical Chemistry*, v. 60, Nov. 1956, p. 1473-1476.

Negative limits for AgCl, AgBr, and AgI with various concentrations of $NaNO_3$, and from the AgI system with various concentrations of $Ba(NO_3)_2$. Coagulation values for Na^+, Ba^{2+}, and La^{3+} in the negative stability region from *p*I 1 to the negative activity limit of stability.

3660 The Solubility of Hydrogen in Diborane. Jih-Heng Hu and George E. MacWood. *Journal of Physical Chemistry*, v. 60, Nov. 1956, p. 1483-1486.

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3661 The Kinetics of the Thermal Decomposition of Sodium Nitrate and of the Reaction Between Sodium Nitrite and Oxygen. Eli S. Freeman. *Journal of Physical Chemistry*, v. 60, Nov. 1956, p. 1487-1493.

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3663 Energetics of the Boranes. III. The Enthalpy and Heat Capacity of Trimethylamine-Trifluoroborane as Determined by the Drop Method. S. H. Bauer and R. E. McCoy. *Journal of Physical Chemistry*, v. 60, Nov. 1956, p. 1529-1532.

3664 Effects of the Spreading Solvent on Monolayers as Determined by Pressure Area and Radioactivity-Area Isotherms. Hurley D. Cook and Herman E. Ries, Jr. *Journal of Physical Chemistry*, v. 60, Nov. 1956, p. 1533-1536.

3665 Acid Dissociation Constants of Substituted 1,10-Phenanthrolines. Alfred A. Schilt and G. Frederick Smith. *Journal of Physical Chemistry*, v. 60, Nov. 1956, p. 1546-1548.

Potentiometric measurements on 40 compounds.

3666 Reduction of Hexavalent Chromium at the Rotated Platinum Electrode. Permeability of the Film Formed. I. M. Kolthoff and A. M. Shams El Din. *Journal of Physical Chemistry*, v. 60, Nov. 1956, p. 1564-1568.

3667 Kinetics and Mechanism of the Hydrogenation of Cyclopropane Over a Nickel-Silica-Alumina-Catalyst. John E. Benson and Takao Kwan. *Journal of Physical Chemistry*, v. 60, Dec. 1956, p. 1601-1605.

3668 Hydrogen Sorption and the Parahydrogen Conversion on Evaporated Nickel Films. J. H. Singleton. *Journal of Physical Chemistry*, v. 60, Dec. 1956, p. 1606-1611.

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3669 The Surface Pressure of Soluble Benzoic Acid Films at Water-Halobenzene Interfaces. Joseph J. Jasper and T. Donald Wood. *Journal of Physical Chemistry*, v. 60, Dec. 1956, p. 1625-1627.

The differential method, furnished by a vertical-pull film balance, was used to measure the interfacial surface pressures of films which formed spontaneously between water and three halobenzenes.

3670 Kinetics of Nitridation of Magnesium and Aluminum. Prasom Sthapitanonda and John L. Margrave. *Journal of Physical Chemistry*, v. 60, Dec. 1956, p. 1628-1633.

3671 Systematic Analysis of Carbon Black Structures. Leroy E. Alexander and Elmer C. Sommer. *Journal of Physical Chemistry*, v. 60, Dec. 1956, p. 1646-1649.

Diffraction data for three representative blacks: acetylene, Furnex, and Micronex.

3672 A Comparison of Pycnometric and X-Ray Densities for the Sodium Chloride-Sodium Bromide and Potassium Chloride-Potassium Bromide Systems. John S. Wollam and W. E. Wallace. *Journal of Physical Chemistry*, v. 60, Dec. 1956, p. 1654-1656.

3673 An Electronic Analogue of the Saturated Vapour Pressure Curve of Water. R. J. Taylor. *Journal of Scientific Instruments*, v. 33, Nov. 1956, p. 436-438.

3674 An All-Glass Reference Electrode for Molten Salt Systems. J. O'M. Bockris, G. J. Hills, D. Inman, and L. Young. *Journal of Scientific Instruments*, v. 33, Nov. 1956, p. 438-439.

Construction and performance of glass electrode generally applicable to molten salt systems up to 550 C.

3675 Polarographic Determination of Rate of Periodate Oxidation of Epimeric Open-Chain 1,2-Glycols. P. Zuman, J. Sicher, J. Krupicka, and M. Svoboda. *Nature*, v. 178, Dec. 22, 1956, p. 1407-1408.

3676 Radiation Induced Nitrite Formation From Concentrated Nitrate Solutions. Harvey A. Mahlman. *Oak Ridge National Laboratory (U. S. Atomic Energy Commission)*, ORNL-2208, Dec. 1956, 42 p. (UF767 U3o Contin.)

Of particular interest were the effect of the cation and the effect of concentration with γ-ray radiation.

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3678 Physical Chemistry. Neil Kensington Adam. 658 p. 1956. Clarendon Press, Oxford. (QD453 Ad14p)

A basic textbook for the advanced student in chemistry and related fields. References are to specialized rather than generalized material.

3679 Variation of the Amplitude of Thermal Vibration on the Fusion Curve. J. J. Gilvarry. *Physical Review*, v. 104, ser. 2, Nov. 15, 1956, p. 908-913.

3680* (English.) **State of Association of Water Molecules in Aqueous Solutions as Deduced From Sound Velocity Data.** Otohiko Nomoto. *Physical Society of Japan, Journal*, v. 11, no. 11, Nov. 1956, p. 1146-1152.

Studies on aqueous solutions of methanol, ethanol, n-propanol, iso-propanol, and acetone.

3681 Photoelectric Emission From the Valence Band of Cesium Iodide. H. R. Philipp and E. A. Taft. *Physics and Chemistry of Solids*, v. 1, Nov. 1956, p. 159-163.

Abrupt rise in photo-electric yield of CsI when $h\nu$ reaches 6 e. v. is interpreted as emission from the valence band with an upper edge 6 e. v. below the vacuum level.

3682 Self-Diffusion and Electrical Conductivity in Silver Chloride. W. Dale Compton and Robert J. Maurer. *Physics and Chemistry of Solids*, v. 1, Nov. 1956, p. 191-198.

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3683* (English.) **Free-Electron Model of Benzene.** Gentaro Araki. *Progress of Theoretical Physics*, v. 16, Sept. 1956, p. 212-221.

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3685 The Electronic Structure and Magnetic Properties of Uranyl-Like Ions. II. Plutonyl. J. C. Eisenstein and M. H. L. Pryce. *Royal Society, Proceedings*, v. 238, ser. A, Dec. 4, 1956, p. 31-45.

The Hamiltonian; optical absorption spectrum; paramagnetic resonance; paramagnetic susceptibility.

3686 Changes in the Infra-Red Spectra of Molecules Due to Physical Adsorption. N. Sheppard and D. J. C. Yates. *Royal Society, Proceedings*, v. 238, ser. A, Dec. 4, 1956, p. 69-89.

Spectra for methane, ethylene, acetylene, and H adsorbed on porous glass.

3687 The Catalytic Fission of the Carbon-Nitrogen Bond. I. The Reactions of Methylamine and Hydrogen on Evaporated Metal Films. C. Kemball and R. L. Moss. *Royal Society, Proceedings*, v. 238, ser. A, Dec. 4, 1956, p. 107-116.

3688 Transport Processes in Applied Chemistry. R. C. L. Bosworth. 387 p. 1956. John Wiley & Sons, New York. (TP156.F6 B65t)

Kinetic mechanisms of all types of transport process are discussed on the basis of the types of carrier responsible for the flow.

3689 The Crystal Structures of a Triazole and Choline Chloride. Michael E. Senko. *University of California, Radiation Laboratory (U. S. Atomic Energy Commission)*, UCRL-3521, Sept. 1956, 47 p. (UF767 U3u Contin.)

Least-squares refinements were carried out on an IBM type 650 Data Processing Machine; program used for these refinements is briefly described.

3690 The Crystal Structure of Tetra-n-Propyl Ammonium Bromide. Allan Zalkin. *University of California, Radiation Laboratory (U. S. Atomic Energy Commission)*, UCRL-4745, Oct. 1956, 16 p. (UF767 U3u Contin.)

The ions pack in the cubic ZnS-type arrangement; cell constants are presented.

3691* (Russian.) Semiconductors as Catalysts in Chemical Reactions. **Poluprovodniki kak katalizatory khimicheskikh reaktsii.** F. F. Vol'kenshtein. *Uspekhi Fizicheskikh Nauk*, v. 60, no. 2, Oct. 1956, p. 249-293.

Activity and selectivity of adsorbed catalysts. Electronic processes during chemical adsorption. Adsorptive ability of a surface.

3692* (German.) Gaseous Iron(III) Iodide and the Equilibrium in the System Iron-Iodine. **Das gasförmige Eisen(III)-jodid und die Gleichgewichte im System Eisen-Jod.** Harald Schäfer and Walter Jerg Hönes. *Zeitschrift für Anorganische und Allgemeine Chemie*, v. 288, nos. 1-2, Nov. 1956, p. 62-80.

The thermal decomposition of FeI_2. Measurement of saturation pressures of solid and liquid FeI_2.

3693* (German.) The Structure of Thin Vaporized Layers of Arsenic and Iodine at Low Temperatures. **Struktur dünner Aufdampfschichten von Arsen und Jod bei tiefen Temperaturen.** H. Grimminger and H. Richter. *Zeitschrift für Naturforschung*, v. 11a, no. 11, Nov. 1956, p. 942-945 + 2 plates.

When examined in an electron diffraction tube, layers of As at room temperature showed a differentiation of their structures; Sb presented no changes; I showed a finely crystalline orthorhombic form.

3694* (German.) Certain Investigations of Silver Iodide in Respect to Formation of Holes. **Über einige Untersuchungen am Silberjodid im Hinblick auf die Fehlordnung. III.** The Electrical Conductivity of Silver Iodide Under Various Pressures. **Die elektrische Leitfähigkeit des Silberjodids bei verschiedenen Drucken.** K. H. Lieser. *Zeitschrift für Physikalsche Chemie (Frankfurt)*, v. 9, nos. 5-6, Dec. 1956, p. 302-317.

Effect of temperature on electrical conductivity of β-AgI at room temperature and α-AgI at 150 to 250 C was investigated in the range of pressure up to 150 atm. (N pressure). Conformity with the theory of ionic electrical conductivity in crystals is discussed.

3695* (Russian.) System $PbCl_2$-PbI_2. **Sistema $PbCl_2$-PbI_2.** T. Sumarokova and T. Modestova. *Zhurnal Neorganicheskoi Khimii*, v. 1, no. 9, Sept. 1956, p. 2027-2031.

Investigation by means of thermal analysis of the solubility of the components and stable equilibriums. $PbCl_2$ has two modifications.

3696* (Russian.) Physical-Chemical Investigation of Reaction Between Titanium Tetrachloride and Monobasic Acid Esters. **Fiziko-khimicheskoe issledovanie vzaimodeistviia chetyrekhkhloristogo titana so slozhnymi efirami odnoostnovnykh kislot. VIII.** Reaction Between Titanium Tetrachloride and n-Butylformate and Isoamylformate. **Vzaimodeistvie chetyrekhkhloristogo titana s n-butilformiatom i izoamilformiatom.** Iu. A. Lysenko. *Zhurnal Obshchei Khimii*, v. 26, no. 11, Nov. 1956, p. 2963-2968.

See also: **3898** (diffusion of H in ZnO); **4217** (sublimation of cryolite); **4420** (radiation effects in solids).

COATINGS

3697 Artificial Aging in Test Chambers Versus Natural Aging in the Field and in Extreme Environments. Alfred N. Bloch. *American Paint Journal*, v. 41, Jan. 14, 1957, p. 98 + 9 pages.

Correlation between natural and artificial aging. Present problems and future outlook of accelerated test methods.

3698 An Engineering Approach to the Estimating of Maintenance Painting. R. F. Williams and J. H. Cogshall. *Corrosion*, v. 13, Jan. 1957, p. 3-11.

Procedure for estimating cost of industrial maintenance program involves the effect on painting costs of such variables as paint material, coating application, surface condition, pre-treatment, surface configuration, rigging, interference, environment, and posture required for painter.

3699* Swelling of Paint Films in Water. IX. Effects of Temperature During Soaking and Film Formation, and Repeated Soaking and Drying. F. L. Browne. *Forest Products Journal*, v. 6, Oct. 1956, p. 453-458.

Free films of most linseed oil paints, both artificially weathered and unweathered, absorb more water, swell more, and lose more soluble material as the temperature of the water in which they are soaked increases.

3700 (Danish.) Manual of Painting and Wall-Papering. **Fagbog for farve-og tapetbranchen.** K. O. Rasmussen. 355 p. 1955. Farve Og Tapet, Copenhagen. (TP935-F13)

Coatings for interior walls. Paint materials and recipes.

3701 Protecting Molybdenum at High Temperatures. *Materials & Methods*, v. 44, Dec. 1956, p. 84-89.

New coating developments show that electrodeposited Cr and Ni layers can protect Mo up to 2000 F, sprayed coatings may be applicable from 2000 to 2400 F, and ceramic and Mo disilicide coatings hold promise for still higher temperatures.

3702 Acrylic Coatings for Metal Products. Gerould Allyn. *Materials & Methods*, v. 44, Dec. 1956, p. 106-109.

Summary of properties and applications.

3703* Physical Chemistry of Paint Coatings—A Constant Search. Maurice Van Loo. *Official Digest. Federation of Paint and Varnish Production Clubs*, v. 28, Dec. 1956, p. 1126-1156 + 4 plates.

Vortex action; critical pigment volume concentration; durability of films and ultra-violet absorption.

3704* Some Practical Applications of a Wide Range Thin Film Recording Viscometer. C. C. Mell and A. J. Ford. *Official Digest. Federation of Paint and Varnish Production Clubs*, v. 28, Dec. 1956, p. 1214-1230.

A dual head cone and plate viscometer which records virtually instantaneous values of shearing stress at rate of shear range of 0-15 and 0-300 $sec.^{-1}$. Viscometric curves obtained with the instrument on polyamide modified alkyds, thixotropic paints, and mill grinding bases.

3705* Adhesion and Adhesives. J. S. Long, C. Whitemarsh, and Wei-Liang Yuan. *Official Digest. Federation of Paint and Varnish Production Clubs*, v. 28, Dec. 1956, p. 1231-1244.

Improved technique in operating Langmuir balance. Limitations of its use. Adhesion data for epoxy resins, linseed oil, tung oil, rosin derivatives, and other substances.

3706* Some Factors to Consider When Formulating Fire-Retardant Coatings for Preserved Timber. S. K. Coburn and K. J. Morris. *Official Digest. Federation of Paint and Varnish Production Clubs*, v. 28, Dec. 1956, p. 1245-1260.

Numerous experiments indicate that various preservative combinations when impregnated at different retentions behave differently with respect to their burning rates, evaporation rates, and weight losses.

3707* Polyvinyl Acetate Dispersions for Exterior Paints. Georg Schulz. *Official Digest. Federation of Paint and Varnish Production Clubs*, v. 28, Dec. 1956, p. 1261-1275.

Emulsions are externally plasticized with dibutyl phthalate and tricresyl phosphate and have sufficient flexibility after outdoor weathering.

3708 Microbiological Factors in Paint Preservation. P. F. Klens and J. F. Lang. *Oil & Colour Chemists' Association, Journal*, v. 39, Dec. 1956, p. 887-899.

Mold causing organisms and their effect on paint films. Paint formulation as it affects mold resistance. Characteristics of fungicides and evaluation methods.

3709 The Evaluation of Some Fungistats for Paint. M. H. M. Arnold and H. J. Clarke. *Oil & Colour Chemists' Association, Journal*, v. 39, Dec. 1956, p. 900-908.

Conditions for mold growth. A method of evaluation which involves growth of mold through a paint film from an infected masonry substrate. Fungistatic activity of 15 compounds.

3710 Development of Emulsion Gloss Paints. A. C. Fletcher and J. E. O. Mayne. *Oil & Colour Chemists' Association, Journal*, v. 39, Dec. 1956, p. 923-933.

Advantages of paints based on polyvinyl acetate emulsions include shorter drying time, freedom from odor, better alkali resistance, and suitability for bright colors. Their gloss is somewhat inferior, and film hardness and application properties require improvement.

3711 Colored Finishes for Copper. A. I. Heim. *Product Engineering*, v. 27, Dec. 1956, p. 135-142.

Natural finishes on Cu and Cu alloys obtainable through combinations of chemical conversion and mechanical treatment of surface; effect of alloy, coloring solutions, and treatments.

3712* A Spray Method of Applying Polyurethanes. Harold C. Fornwall. *SPE Journal*, v. 13, Jan. 1957, p. 19-21.

Development, use, care, and maintenance of catalyst gun and auxiliary equipment.

3713 Shear Strength at 75° F to 500° F of Fourteen Adhesives Used to Bond a Glass-Fabric-Reinforced Phenolic Resin Laminate to Steel. John R. Davidson. *U. S. National Advisory Committee for Aeronautics, Technical Note* 3901, Dec. 1956, 21 p. (TL570 Un3t)

Tests showed that sandblasting the faying surfaces was a good method of surface preparation.

3714* (German.) Formation of Protective Film on Titanium in Hydrochloric Acid. **Schutzschichtbildung auf Titan in Salzsäure.** Rikuro Otsuka. *Zeitschrift für Metallkunde*, v. 47, no. 11, Nov. 1956, p. 714-715.

If Ti is immersed in HCl it becomes covered by a protective layer of Ti hydride.

See also: **4072** (silicone coatings); **4180** (coatings for protection against H_2S); **4201** (corrosion resistance of flame-sprayed Zn coatings); **4312** (electric conductivity of Ni coatings); **4319** (reflectance of Al films); **4324** (vacuum evaporated films); **4706** (ventilation of ovens for baking paint); **4730** (paper coating bond tester).

CONTROL SYSTEMS, COMPUTERS, AND SYSTEMS ENGINEERING

3715 Developments in Automatic Packaging Equipment. *American Management Association, Packaging Series No.* 51, 1956, 19 p. (HF5770 Am35p Vis.)

Three papers noting experiences of three different companies.

3716 Automatic Digital Calculators. Andrew D. Booth and Kathleen H. V. Booth. 2nd Rev. Ed. 261 p. 1956. Butterworths Scientific Publications, London. (TK7872.C5 B64a2)

Theory, design, construction, and use.

3717* Developing Small Scale Automation. F. F. White. *Automation*, v. 4, Jan. 1957, p. 40-44.

Economics of automation. Main criteria to be considered for small installations.

3718* Assembling Razors Automatically. E. M. Sullivan and C. O. Merchant. *Automation*, v. 4, Jan. 1957, p. 45-50.

Equipment and operating procedures.

3719* Regulators at Work. Anton G. Seifried. *Automation*, v. 4, Jan. 1957, p. 54-60.

Proper selection of regulating systems for individual applications. Examples of successful systems.

3720* Preparing for Numerical Control in Parts Machining. Robert E. Reiter. *Automation*, v. 4, Jan. 1957, p. 70-74.

Application of programmed controls to production machines.

3721 Automation—Friend or Foe? R. H. MacMillan. 100 p. 1956. Cambridge University Press, New York. (T59.5 M11a)

Development of automatic control; evolution of automatic production; control system design problems; economics of automation; automatic computers; present impact and future prospects.

3722* Industrial Data - Reduction and Analogue - Digital Conversion Equipment. P. Partos. *British Institution of Radio Engineers, Journal*, v. 16, Dec. 1956, p. 651-678.

Representative data-reduction specifications. Electro-mechanical and electro-optical devices, and pure electronic converters. Main features of other major elements.

3723* Grid Control of Thyratrons With Particular Reference to Servo-Mechanism Applications. K. R. McLachlan. *British Institution of Radio Engineers, Journal*, v. 16, Dec. 1956, p. 695-699.

A circuit enabling linear control of a system for simulating the characteristics of an internal combustion engine.

3724 The General-Purpose Analog Computer. Theodore J. Williams and Clarence L. Johnson. *Chemical Engineering Progress*, v. 52, Nov. 1956, p. 457-463.

Applications of the device and skills required for its operation.

3725 The Large Computer Installation. Arthur E. Hoerl. *Chemical Engineering Progress*, v. 52, Nov. 1956, p. 464-466.

Examples of problems justifying the purchase of a million dollar machine.

3726 Applications of Electronic Process Control Instrumentation. H. J. Ruston. *Chemical Engineering Progress*, v. 52, Nov. 1956, p. 485-487.

Applications and use of compatiable electronic computer including calculating, automatic monitoring, scanning, and printing devices.

3727 The Use of Computing Machines in the Statistical Evaluation of Electrical Components. W. E. Andrus, Jr. *Communication and Electronics*, Nov. 1956, p. 501-505.

3728 Optimum Linear-Segment Function Generation. Howard Hamer. *Communication and Electronics*, Nov. 1956, p. 518-520.

An analytic technique which makes it possible to determine the smallest error obtainable and the break points and slopes which will achieve the optimum approximation.

3729 Numerical Integration of Differential Equations on the 704 EDPM. H. H. Anderson and J. R. Johnson. *Communication and Electronics*, Nov. 1956, p. 569-574.

3730 Magnetic Logic Circuit Control System Design Considerations. R. I. Van Nice. *Communication and Electronics*, Nov. 1956, p. 595-600.

The logical properties of a set of magnetic logic circuits; a simple algebraic representation of their performance. Effects of the physical characteristics of magnetic logic circuits on various aspects of switching circuit design. Advantages of simulators for verification and education.

3731 A Data Transmission Machine. C. R. Doty and L. A. Tate. *Communication and Electronics*, Nov. 1956, p. 600-603.

The IBM Data Transceiver reads and transmits information from punched cards, and records the information by punching cards at the receiving location. Transmission may be over telephone or telegraph circuits, using wire, radiotelegraph, or microwave.

3732* Indexing for Rapid Random Access Memory Systems. Arnold I. Dumey. *Computers and Automation*, v. 5, Dec. 1956, p. 6-9.

3733 The Power Stepping Motor—A New Digital Actuator. A. G. Thomas and Fred J. Fleischauer. *Control Engineering*, v. 4, Jan. 1957, p. 74-81.

Simple rugged construction leads to high reliability, speeds to 100,000 steps per min. and torque outputs to 3,000 in.-lb. Performance characteristics and applications are shown.

3734 Applying Thyratrons to Control. James H. Burnett. *Control Engineering*, v. 4, Jan. 1957, p. 88-96.

Explores the remarkable potential for the thyratron tube as an amplifier in driving high-performance military and industrial servo systems.

3735 Solving Problems With a Digital Computer. Alston S. Householder. *Control Engineering*, v. 4, Jan. 1957, p. 99-105.

Mathematical repertory of the machine; techniques for solving ordinary linear and nonlinear equations and systems of equations, and for representing functions.

3736 Control Consistency With a Flow Bridge. David Eolkin and Victor Head. *Control Engineering*, v. 4, Jan. 1957, p. 107, 109.

Eolkin's flow bridge has an output that is essentially independent of the viscosity of the flowing liquid, yet proportional to the yield stress, often an important factor in product quality.

3737 Principles of Programming. J. B. Ward. *Electrical Engineering*, v. 75, Dec. 1956, p. 1078-1083.

A hypothetical sample computer having a limited order code and some examples of simple programming illustrate the general principles of programming as well as some aspects of the type of thinking necessary for utilizing computers of this kind.

3738 Solving Thermal-Circuit Problems With Computers. A. E. Johnson. *Electrical Engineering*, v. 75, Dec. 1956, p. 1084.

3739 Nonlinear Control-System Response to Random Signals. P. N. Nikiforuk. *Electrical Engineering*, v. 75, Dec. 1956, p. 1092.

3740 Power Generation and Distribution at Air Defense Computing Centers. J. J. Gano. *Electrical Engineering*, v. 75, Dec. 1956, p. 1098-1102.

By installing reserve generating capacity, duplexing the power-distribution system, and emphasizing equipment reliability, continuity is achieved.

3741* Static D-C References for Closed-Loop Controls. Michel Mamon. *Electrical Manufacturing*, v. 59, Jan. 1957, p. 54 + 10 pages.

Review of recent developments in the magnetics and solid state fields which have made available a variety of circuits having the reliability characteristic of static devices and able to furnish constant reference potential despite wide swings in input voltage.

3742 Thyratrons Control Die-Cutting Machine. Robert W. Bradley. *Electronics*, v. 30, Jan. 1, 1957, p. 162-165.

Time-delay and two-thyratron control circuits stop hydraulically actuated cutting die as it completes circuit between conductive surface of cutting pod and beam striking plate.

3743 Pneumatic Computing Elements for Automatic Controls. W. Frede. *Engineers' Digest*, v. 17, Nov. 1956, p. 480-482.

Development of pneumatic computing elements capable of performing various arithmetical operations in control circuits.

3744 Transient Effects of Supply and Connecting Conduits in Hydraulic Control Systems. S. S. L. Chang. *Franklin Institute, Journal*, v. 262, Dec. 1956, p. 437-452.

Basic equations for transient flow of a slightly compressible fluid in a metal tubing are derived for both laminar and turbulent flow and applied to hydraulic control systems.

3745 The Representation of Constraints by Means of Electronic Differential Analyzer. Donald T. Greenwood. *Institute of Radio Engineers, Transactions on Electronic Computers*, v. EC-5, Sept. 1956, p. 111-113. (TK1 In6.6e Vis.)

Use of high-gain amplifiers enables one to represent constrained systems in a manner such that all coordinates are available for the application of arbitrary forces or displacements.

3746 High-Speed Shift Registers Using One Core Per Bit. V. L. Newhouse and N. S. Prywes. *Institute of Radio Engineers, Transactions on Electronic Computers*, v. EC-5, Sept. 1956, p. 114-120. (TK1 In6.6e Vis.)

Basic circuit operation and variations; use in computer logic applications.

3747 Logic Circuits for a Transistor Digital Computer. G. W. Booth and T. P. Bothwell. *Institute of Radio Engineers, Transactions on Electronic Computers*, v. EC-5, Sept. 1956, p. 132-138. (TK1 In6.6e Vis.)

3748 Digital Time and Sequence Control. Martin L. Klein, Frank K. Williams, and Harry C. Morgan. *Instruments and Automation*, v. 29, Dec. 1956, p. 2403-2407.

The binary-wired switch permits simple trunking of a matrix line. Four sets of such switches are used with relays to control a sequence of events in the variable-interval automatic controller.

3749* Frequency Response of Pneumatic Transmission Lines. R. P. Sandell and N. H. Ceaglske. *ISA Journal*, v. 3, Dec. 1956, p. 482-485.

Extends the experimental data on five sizes of tubing and compares frequency response data with an electrical analogy.

3750 Electronic Analog Computer Solutions of Nonlinear Vibratory Systems of Two Degrees of Freedom. C. P. Atkinson. *Journal of Applied Mechanics*, v. 23, Dec. 1956, p. 629-634.

Use of an electronic differential analyzer for solving the exact differential equations of such systems. Comparison of solutions with the approximate analytical solutions obtained from a single-term harmonic approximation.

3751 Hydraulic Servo Components. II. Their Effect on System Performance. J. M. Nightingale. *Machine Design*, v. 28, Dec. 13, 1956, p. 133-136.

Servomotors, preamplifiers, transducers, and feedback elements.

3752 Comparing Analog and Digital Computers for Solving Design Problems. D. B. Breedon. *Machine Design*, v. 28, Dec. 13, 1956, p. 140-142, 144.

3753 Applying Meter-Relays. Paul Saint-Amour. *Machine Design*, v. 29, Jan. 10, 1957, p. 133-138.

Types, ranges, performance characteristics, and application data for instruments that serve as both indicating meters and control relays.

3754* Optimal Design and Utilization of Communication Networks. R. E. Kalaba and M. L. Juncosa. *Management Science*, v. 3, Oct. 1956, p. 33-44.

Shows that fundamental optimal routing and design problems for communication networks may be treated in a straightforward, computationally feasible manner by linear programming methods.

3755 Analysis of Atomic Spectra With Electronic Digital Computers. K. G. Kessler, S. B. Prusch, and I. A. Stegun. *Optical Society of America, Journal*, v. 46, Dec. 1956, p. 1043-1045.

Techniques are applied to the analysis of the arc spectrum of Ru.

3756 Reactor Calculations on the Card-Programmed Calculator. D. D. Dix. *Phillips Petroleum Company, Idaho Operations Office (U. S. Atomic Energy Commission)*, IDO-16221, Apr. 1955, 53 p. (UF767 Un3.1id Contin.)

Reactivity and criticality calculations for the MTR.

3757* Analogue Computer Representations of Synchronous Generators in Voltage-Regulation Studies. M. Riaz. *Power Apparatus and Systems*, no. 27, Dec. 1956, p. 1178-1184.

Develops a general block-diagram representation of the synchronous generator when applied to voltage-regulating system studies. Includes saturation effects variable-speed operation, variable-load factor, and effects of saliency and damper circuits.

See also: **3281** (aircraft automatic pilots); **3422** (*p*H control devices); **3886** (electronic circuits); **4066** (machine translation of language); **4398** (automatic inspection and sorting system); **4529** (business data-processing machines); **4534** (electronic computer applications); **4544** (systems planning and control); **4546** (automatic computers in business offices).

ELECTRICAL ENGINEERING

3758* (Spanish.) Some Remarks on a Problem in Electrodynamics. **Observaciones al margende un problema electrodinámico.** Granes Deulofeu. *Acero y Energia*, v. 13, no. 77, Sept.-Oct. 1956, p. 61-66.

Study of a method for the calculation of the electrodynamic field intensity produced by a variation of the magnetic field and determination of the tension induced between the ends of a fixed open conductor in this field.

3759 Calculation of the Magnetic Noise of Polyphase Induction Motors. Philip L. Alger and Edward Erdelyi. *Acoustical Society of America, Journal*, v. 28, Nov. 1956, p. 1063-1067.

3760* Breakdown of Liquid Insulating and Dielectric Material. J. A. Kok and M. M. G. Corbey. *Applied Scientific Research*, v. 6, sec. B, no. 3, 1956, p. 197-206.

Breakdown is explained by the gathering of particles of high dielectric constant, particularly conductors, at a place of maximum stress.

3761 The Art and Science of Protective Relaying. C. Russell Mason. 410 p. 1956. John Wiley & Sons, New York. (TK2861 M38a)

An elementary approach supplying basic principles of design and application for the novice and refresher information for the practicing engineer.

3762 Multiplicity in the Anode Marks of Sparks. J. M. Somerville and C. T. Grainger. *British Journal of Applied Physics*, v. 7, Nov. 1956, p. 400-405.

Nature of mark is determined in the first few tenths of a μsec. of the life of the spark and depends chiefly on the number of contaminating layers on the anode, on the rate of rise of current in the spark, and on the breakdown voltage of the spark gap.

3763 The Fusing of Wires With Heavy Surge Currents. A. E. Barrington. *British Journal of Applied Physics*, v. 7, Nov. 1956, p. 408-410.

Complete melting does not occur prior to break-up. Nature of arc discharge following break-up depends on length and material of the wires when exploded in air, but independent of these when exploded in vacuum.

3764 The Electric Strength of Hydrocarbon Gases. A. E. D. Heylen and T. J. Lewis. *British Journal of Applied Physics*, v. 7, Nov. 1956, p. 411-415.

Measurements of the static electric strengths of a number of pure hydrocarbon gases over a range of pressure and spark-gap spacings, including the Paschen minimum. Pulse discharges which occur readily in these gases at fields below the breakdown value are attributed to their exceedingly small secondary-ionization coefficients.

3765 A Variational Principle for Conduction Phenomena in the Presence of a Magnetic Field or Asymmetric Scattering Mechanisms. Alfred Seeger. *Canadian Journal of Physics*, v. 34, Suppl. no. 12A, Dec. 1956, p. 1278-1280.

3766 Manufacture of Wire Spring Relays for Communication Switching Systems. James W. Rice. *Communication and Electronics*, Nov. 1956, p. 513-518.

Manufacturing processes and equipment for mass production of molded wire subassemblies.

3767 An Instrument to Record Voltage Flicker. V. H. Kraybill and H. M. Jensen. *Communication and Electronics*, Nov. 1956, p. 527-531.

3768 Traffic Considerations in Community Dial Offices. S. J. Lanigan and T. J. McDonough. *Communication and Electronics*, Nov. 1956, p. 543-548.

Some telephone traffic engineering standards.

3769 Computation of the Impedances of Nonuniform Lines by a Direct Method. Louis A. Pipes. *Communication and Electronics*, Nov. 1956, p. 551-554.

3770 Dynamic Behavior of a 3-Phase Magnetic Amplifier. F. J. Ellert. *Communication and Electronics*, Nov. 1956, p. 554-561.

3771 A Field Survey of Transformer Oil Quality. W. J. Degnan and E. J. Shimanski. *Communication and Electronics*, Nov. 1956, p. 575-579.

Sampling technique; oil tests and what they signify; electrical, chemical, and physical properties of various oils.

3772 How to Phase-Compensate Loaded Potentiometers. Jack Gilbert. *Control Engineering*, v. 4, Jan. 1957, p. 82-87.

Any potentiometer can be corrected for predictable quadrature functions of the output by using the proper number of taps and compensating capacitors.

3773 A New 115-Kv 1,000-Mva Gas-Filled Circuit Breaker. C. F. Cromer and R. E. Friedrich. *Electrical Engineering*, v. 75, Dec. 1956, p. 1085.

Device utilizes the unique arc-interrupting and insulating characteristics of SF_6 gas.

3774 In-Service Winding Temperature Measurement. P. K. Pavlides. *Electrical Engineering*, v. 75, Dec. 1956, p. 1091.

A radiation pyrometer for measuring temperatures of windings of 25-cycle single-phase generators of two large frequency changers.

3775 Isolated Phase Telescoping Bus Duct. S. C. Killian and K. Boyajian. *Electrical Engineering*, v. 75, Dec. 1956, p. 1094-1097.

Designed to fulfill the requirements of easy installation and convenient inspection, this new type of waterproof bus duct needs a minimum of gaskets.

3776 Epoxy Resin Casting of Dry-Type High-Voltage Components. C. W. Park. *Electrical Engineering*, v. 75, Dec. 1956, p. 1104-1106.

Molding process; techniques used in determining optimum shapes.

3777 (German.) Electrical Power Stations and Networks. **Elektrische Kraftwerke und Netze.** H. Happoldt. 3rd Ed. 579 p. 1956. Springer-Verlag, Berlin. (TK1001 B85e)

Introductory work into fields of power generation and distribution. Only the necessary minimum amount of mathematics and formulas are used.

3778 The Production and Testing of Potted Circuits. T. C. B. Talbot. *Electronic Engineering*, v. 28, Dec. 1956, p. 512-516.

Development of a technique for the production of small batches of 100 or less potted circuits. Its application to the production of a typical unit. Special test gear for use with potted circuits.

3779 Designing Airborne Equipment for Vibration. Salvatore P. Mercurio, Jr. and Michael Belby. *Electronics*, v. 30, Jan. 1, 1957, p. 166-168.

Proper selection and design of components contributes to reliability under high vibration conditions.

3780* (English.) **Francis Turbines, Alternating Current Generators and Controlling Equipment for the Sakuma Power Station.** Tsuneo Goto and Takuro Ando. *Hitachi Review*, no. 15, Oct. 1956, p. 3-21.

Design and construction details for 100,000 kw. turbine, 93,000 kv.-amp. generators, and control equipment.

3781* How to Clean Silicone Insulated Electrical Equipment. Clayton Doremire. *Insulation*, v. 3, Jan. 1957, p. 13-15.

3782 Distribution of Power in a Modern Cold Mill. E. A. Young, Frank Nolan, and A. D. Millikin. *Iron and Steel Engineer*, v. 33, Dec. 1956, p. 82-88.

Design considerations. Pump type rectifiers are used in an underground system with distribution voltages of 11,000, 2300, and 440.

3783* (Russian.) Analysis of the Vibration Process in a Synchronous Machine, With a Consideration of the Regulation of Excitation. **Analiz kolebatel'nogo protsessa sinkhronnoi mashiny s uchetom regulirovaniia vozbuzhdeniia.** I. D. Urusov. *Izvestiia Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk*, no. 10, Oct. 1956, p. 77-89.

Simplified method of determining the character of the disturbed operation of the rotor reduced to a single pair of complex roots obtained by iteration or graphically.

3784 Electrical Conductivity of Barium Oxide Single Crystals as a Function of Temperature and Excess Barium Density. R. T. Dolloff. *Journal of Applied Physics*, v. 27, Dec. 1956, p. 1418-1426.

3785 Xenon Arc Transients, Electrical and Optical. George W. LeCompte and Harold E. Edgerton. *Journal of Applied Physics*, v. 27, Dec. 1956, p. 1427-1430.

Growth of the luminous area of a high current discharge in an electronic xenon-filled flashtube was studied by means of a sequence of timed short-exposure photographs taken with a magneto-optic shutter. Tube conductance was proportional to the luminous area of the arc channel.

3786 Dielectric Properties of Lower-Membered Polyethylene Glycols at Low Frequencies. Naokazu Koizumi and Tetsuya Hanai. *Journal of Physical Chemistry*, v. 60, Nov. 1956, p. 1496-1500.

Properties of seven polymeric homologs of glycol from ethylene glycol to heptaethylene glycol measured in liquid, supercooled liquid, and solid state from −70 to + 60 C.

3787 An Electrostatic Null Detector. J. Hart and A. G. Mungall. *Journal of Scientific Instruments*, v. 33, Nov. 1956, p. 411-412.

Detector for use in very high resistance bridge circuits has a sensitivity better than 0.5 v.

3788 Surface Energies in Superconductors. H. W. Lewis. *Physical Review*, v. 104, ser. 2, Nov. 15, 1956, p. 942-947.

A variational method is applied.

3789 Townsend Ionization Coefficents and Uniform Field Breakdown in Hydrogen and Nitrogen at High Pressures. D. J. DeBitetto and L. H. Fisher. *Physical Review*, v. 104, ser. 2, Dec. 1, 1956, p. 1213-1220.

Measurements at various electrode separations and gas pressures.

3790 Molecular Theory of the Dielectric Constant of Nonpolar Gases. L. Jansen and A. D. Solem. *Physical Review*, v. 104, ser. 2, Dec. 1, 1956, p. 1291-1297.

A theory of molecular polarization is developed which applies to nonpolar gases consisting of axially symmetric molecules. The interaction Hamiltonian of the system includes induced dipole and induced and permanent quadrupole contributions.

3791 Changes in Conductivity Resulting From Breakdown in Cadmium Sulphide Single Crystals. J. Woods. *Physical Society, Proceedings*, v. 69, no. 442B, Oct. 1956, p. 975-980.

For small applied fields the resistivity of a pure CdS crystal is very high. For fields greater than a critical value, however, dielectric breakdown occurs and large currents flow.

3792* The Development and Testing of a 300-Kv Air-Blast Circuit Breaker for Severe Duties. J. Christie, D. F. Amer, and A. F. B. Young. *Power Apparatus and Systems*, no. 27, Dec. 1956, p. 1056-1069.

3793* The ALCUnector—An All-Weather Connector for Aluminum-to-Copper Conductors. E. W. Greenfield and A. H. Selker. *Power Apparatus and Systems*, no. 27, Dec. 1956, p. 1069-1081.

Background and evaluation of a safe means for joining Al-to-Cu conductors which is suitable for application to all exposed circuits in any natural environment.

3794* An All-Purpose Directional-Impulse Method of Cable Fault Locating and Identification. E. K. Anderson, Jr. *Power Apparatus and Systems*, no. 27, Dec. 1956, p. 1119-1125.

Method permits direct connection of transformers to feeder cables in networks area, eliminating need for costly disconnecting devices, or the time for operating such disconnects for fault locating.

3795* Ultrasonic Detection and Location of Electric Discharges in Insulating Structures. J. G. Anderson. *Power Apparatus and Systems*, no. 27, Dec. 1956, p. 1193-1198.

A simple method for detecting and locating impulse and L.F. corona, and breakdowns in some types of insulating structures and apparatus, is essentially an adaptation of sonar techniques of triangulation and ranging.

3796* Mechanical Features of New Frame-Mounted Outdoor Oil Circuit Breakers. E. R. Perry, J. F. Claffie, and W. L. Vance. *Power Apparatus and Systems*, no. 27, Dec. 1956, p. 1205-1212.

3797* A New High-Interrupting-Capacity Low-Voltage Circuit Breaker. W. Harold Edmunds. *Power Apparatus and Systems*, no. 27, Dec. 1956, p. 1212-1220.

Construction, performance, and applications.

3798 Controlling Temperature Rise in Squirrel Cage Induction-Motor Drives. Charles C. Libby. *Product Engineering*, v. 28, Jan. 1957, p. 167-178.

Significance of temperature rise; effect of duty cycle, braking methods, base speed, and load inertia on motor temperature; improving ventilation and cooling in restricted spaces; factors limiting overload; speed-sensitive loads and mechanical limitations.

3799* A Novel Relay Amplifier. J. H. Askew. *Society of Instrument Technology, Transactions*, v. 8, Dec. 1956, p. 133-143.

Amplifier enables control of a motor to be effected by reversing the polarity of motor armature voltage in a cyclic manner without breaking the main power supply circuit.

3800* (German.) Study of the Discharge Mechanism of the High Temperature Arc. **Zum Entladungsmechanismus des Hochtemperaturbogens.** G. Busz-Peuckert and W. Finkelnburg. *Zeitschrift für Physik*, v. 146, no. 5, Nov. 1956, p. 655-663.

Argon high-temperature arc is described in relation to its essential points of difference from the usual arcs, especially as to carrier and energy balances. The difference between high temperature arc in A or in N.

See also: **3377** (glass dielectrics); **3757** (computer representation of generators); **4740** (static electricity).

ELECTROCHEMISTRY

3801 Electrodeposition of Metallic Titanium in Fused Sodium and Potassium Chlorides Using Titanium Dichloride. H. Tadenuma, H. Ikeda, and K. Fujita. *Henry Brutcher Translation No.* 3832, 6 p. (From *Journal of the Chemical Society of Japan, Industrial Section*, v. 59, 1956, p. 356-357.) Henry Brutcher, Altadena, Calif.

3802 Permeation of Gases Through Electrolytic Nickel Deposits. II. Determination of the Effect of Several Variables on the Intrinsinc Permeability of Nickel Deposits to Gases. D. T. Ewing, J. Martin Tobin, and D. Gardner Foulke. *Electrochemical Society, Journal*, v. 103, Dec. 1956, p. 648-651.

Effects of changing bath composition, *p*H, temperature, and cathodic current density, and adding small amounts of colloidal graphite, gelatin, anode sludge, Fe(III), Cu(II), and Zn as impurities in a Watts' bath.

3803 Electrodeposition of Metals From Organic Solutions. I. General Survey. Abner Brenner. **II. Further Studies on the Electrodeposition of Aluminum From a Hydride Bath.** Jean H. Connor and Abner Brenner. *Electrochemical Society, Journal*, v. 103, Dec. 1956, p. 652-662.

General principles, methods, solutes, and solvents used. Improvements in composition and operation of the bath.

3804 Anodic Reactions. I. Kolbe Electrosynthesis of Ethane Using Alternating Current. Christopher L. Wilson and William T. Lippincott. *Electrochemical Society, Journal*, v. 103, Dec. 1956, p. 672-675.

Kolbe electrosynthesis with acetate was studied in a variety of solvents using 60-cycle a.c. Ethylene glycol, water, and glacial acetic acid were best of the solvents used.

3805 Electrochemical Behavior of 2-Chlorocyclohexanone and Derived Imines. Philip J. Elving and Robert E. Van Atta. *Electrochemical Society, Journal*, v. 103, Dec. 1956, p. 676-681.

3806 New Line Plates Contoured Parts With Few Rejects. Herbert Chase. *Iron Age*, v. 179, Jan. 10, 1957, p. 64-65.

Diecast parts are Cu-, Ni-, and finally Cr-plated on one automatic plating line with less than 2% rejects. Intermittent current is used.

3807 On the Theory of Electrolytic Crystal Growth. D. A. Vermilyea. *Journal of Chemical Physics*, v. 25, Dec. 1956, p. 1254-1263.

Equations are developed for the current as a function of applied voltage during electrolytic solution or deposition at surfaces which are perfect, atomically rough, or smooth except for the steps of screw dislocations. Surface structure does not influence rate of deposition if overvoltage is sufficiently high and time long enough, the rate determining step being ionic discharge.

3808 Surface Treatment and Finishing of Light Metals. XIIB. Plating on Aluminum—Anodic Oxidation Processes. S. Wernick and R. Pinner. *Metal Finishing*, v. 54, Dec. 1956, p. 62-64, 71.

Bath compositions; equipment; methods.

3809* (German.) Testing Electrolytically Polished Metal Surfaces With the Electron Microscope. **Elektronenmikroskopische Untersuchung elektrolytisch geglänzter Metalloberflächen. II.** H. Poppa and H. Spähn. *Metalloberfläche*, v. 10, no. 12, Dec. 1956, p. 358-365.

Study of the influence of electrochemical conditions on the structure of electrolytically polished Cu and brass. Characteristics of the polishing process are described.

3810* (German.) Technical Applications of Electropolishing. Present State of the Technique. **Die technischen Anwendungen des Elektropolierens Augenblicklicher Stand der Technik. II.** R. Mondon. *Metalloberfläche*, v. 10, no. 12, Dec. 1956, p. 376-380.

3811 Conservation of Nickel in Electroplating. V. L. McEnally, Jr. and F. G. Brune. *Metal Progress*, v. 70, Dec. 1956, p. 89-92.

At least one third of the Ni used in electroplating would be saved if deposits of uniform thickness could be obtained. Some techniques for improving uniformity are described.

3812 Stop Chrome Waste, Pollution and Heat Loss. E. W. Neben. *Plating*, v. 44, Jan. 1957, p. 52-55.

New method of operation combines principles of plating bath temperature control with elimination of pollution from rinse waters. Heat from the plating solution that was formerly wasted is used to evaporate water in an acid recovery system.

3813* (French.) Crack Formation Under the Action of Heat in Aluminum Alloy Surfaces After Bright Anodic Oxidation and Heatings. **Le faïençage des surfaces en alliage d'aluminium traitées par oxydation anodique brillante et soumises a des échauffements.** Pierre Lelong and Jean Hérenguel. *Revue de l'Aluminium*, v. 33, no. 236, Oct. 1956, p. 923-930.

A study of conditions needed to avoid or reduce this defect.

3814 Technical Proceedings of the 43rd Annual Convention of the American Electroplaters' Society. 308 p. 1956. American Electroplaters' Society, Newark. (TS670 Am35p Vis.)

Includes 41 papers on various phases of electroplating and allied subjects.

3815 Properties of Electrodeposits at Elevated Temperatures. W. H. Safranek and G. R. Schaer. Paper from "Technical Proceedings of the 43rd Annual Convention of the American Electroplaters' Society". p. 105-117. (TS670 Am35p Vis.)

Properties such as oxidation resistance in air, stress rupture, thermal expansion, thermal stability, ductility, and hot hardness were determined for Ni, Cr, and other electrodeposits. The results of the research showed promising leads for developing improved electrodeposits for protecting Mo and other metals against oxidation at high temperatures.

3816 Electrodeposition of Porous Nickel-Cadmium Alloy. L. D. McGraw, J. P. Spenard, and C. L. Faust. Paper from "Technical Proceedings of the 43rd Annual Convention of the American Electroplaters' Society". p. 209-210. (TS670 Am35p Vis.)

Porous alloy deposits were obtained from a bath containing Ni and Cd salts and colloidal graphite. The effects of bath pH and other process variables was studied. The composition of the deposited alloy is very sensitive to changes in bath composition or current variations.

3817* (Russian.) Reaction Products in Electro-Chemical Polishing of Copper in H_3PO_4. **K voprosu o produktakh reaktsii pri elektrokhimicheskoi polirovke medi v H_3PO_4.** S. I. Krichmar and V. P. Galushko. *Zhurnal Neorganicheskoi Khimii*, v. 1, no. 10, Oct. 1956, p. 2422-2424.

Experimental determination of approximate formula.

3818* (Russian.) Concentration Changes Near the Electrodes of a Chromium Bath and Mechanism of the Chromium Deposition. **O kontsentratsionnykh izmeneniiakh v prielektrodnykh sloiakh kromovoi vanny i mekhanizme elektroosazhdeniia khroma.** A. I. Levin and A. I. Falicheva. *Zhurnal Prikladnoi Khimii*, v. 29, no. 11, Nov. 1956, p. 1673-1683.

The pH values of the area near the cathode during the deposition of metallic Cr were determined as well as the effect of some alloys (Fe, Al) on the pH value of hydration.

3819* (Russian.) On the Problem of Electrolytic Production of Nickel Alloys With Molybdenum and Wolfram. **K voprosu elektroliticheskogo polucheniia splavov nikelia s molibdenom i vol'framom.** T. F. Frantsevich-Zabludovskaia, A. I. Zaiats, and K. D. Modylevskaia. *Zhurnal Prikladnoi Khimii*, v. 29, no. 11, Nov. 1956, p. 1684-1691.

A study of the electrodeposition of Ni-Mo alloys and of Ni-W alloys, from aqueous tartaric and ammoniacal electrolytes.

See also: **3701** (plating Mo with Cr and Ni); **4231** (preparation of parts for electroplating); **4307** (anodic films on Al); **4380** (structure of electropolished Fe and Cu).

ELECTRONICS

3820 Speech Analysis-Synthesis Scheme Using Continuous Parameters. Calvin R. Howard. *Acoustical Society of America, Journal*, v. 28, Nov. 1956, p. 1091-1098.

A device for processing speech for transmission over a narrow-band communication channel is described.

3821 Development and Testing of a Formant-Coding Speech Compression System. James L. Flanagan and Arthur S. House. *Acoustical Society of America, Journal*, v. 28, Nov. 1956, p. 1099-1106.

3822 Advances in Electronics and Electron Physics. L. Marton, editor. v. VIII. 562 p. 1956, Academic Press, New York. (TK161 A95e Vis.)

Critically reviews mol. beams, field emission, mass spectroscopy, nuclear physics measurements, electron beams, magnetron physics, and associated subjects.

3823* Semiconducting Intermetallic Compounds. L. Pincherle and J. M. Radcliffe. *Advances in Physics*, v. 5, July 1956, p. 271-322.

A report on published data relating to preparation, properties, theory, and applications.

3824 Vertical Scanning Air-Borne Radar for Reducing Hazards of Aircraft Icing and Ground Collisions. Louis J. Battan. *Aeronautical Engineering Review*, v. 15, Dec. 1956, p. 52-54.

Modification of presently used air-borne weather-radar to permit vertical scanning in the forward vertical plane. Shows how vertical scanning radar can be used to observe cloud top heights, icing conditions, and the topography ahead of and below the airplane.

3825 Development of DuMont Photomultiplier Tubes. Report No. 19. B. R. Linden, P. A. Snell, and F. W. Schenkel. *Allen B. DuMont Laboratories, Inc., Tube Research Laboratories, (U. S. Atomic Energy Commission)*, RIB-14, Sept. 1956, 13 p. (UF767 Un3.1ri Contin.)

Large area multiplier phototubes; ¾ in. diameter, Cs-Sb Dynode tubes (K1382); linear photomultiplier structures; transit-time spread; Al-Be dynodes.

3826* The Back-Scattering From a Circular Loop. Robert G. Kouyoumjian. *Applied Scientific Research*, v. 6, sec. B, no. 3, 1956, p. 165-179.

Variational method is used to determine echo area of a perfectly-conducting, thin, circular loop. It appears that approximations which have been successfully used for straight wire radiators may be extended to cases where the wire is curved.

3827 The Care and Treatment of Feedback Audio Amplifiers. W. B. Bernard. *Audio*, v. 41, Jan. 1957, p. 20-21, 65-69.

Use of inverse voltage feedback to reduce the output impedance of an amplifier in addition to reducing distortion and noise.

3828* Divergence of Radio Rays in the Ionosphere. G. H. Munro and L. H. Heisler. *Australian Journal of Physics*, v. 9, Sept. 1956, p. 359-372.

3829 Diffusion in Solids—A Breakthrough in Semiconductor Device Fabrication. Morgan Sparks and W. J. Pietenpol. *Bell Laboratories Record*, v. 34, Dec. 1956, p. 441-446.

The technique of diffusing impurities from a gaseous state into the crystal has opened up the possibility of achieving high operating frequencies and high power-handling capacities never before possible with transistors and other semiconductor devices.

3830 Heat Dissipation From Electronic Equipment. Transistor-vs.-Electron Tubes. E. K. Van Tassel. *Bell Laboratories Record*, v. 34, Dec. 1956, p. 456-460.

3831 Single-Oscillator Microwave Measuring System. D. H. Ring. *Bell Laboratories Record*, v. 34, Dec. 1956, p. 465-468.

Design of single-oscillator circuit for accurate measurement of transmission loss or gain of microwave components.

3832 Theory of the Swept Intrinsic Structure. W. T. Read, Jr. *Bell System Technical Journal*, v. 35, Nov. 1956, p. 1239-1284.

The electric field and the hole and electron concentrations are found for reverse biased junctions in which one side is either intrinsic or so weakly doped that the space charge of the carriers cannot be neglected.

3833 A Medium Power Traveling-Wave Tube for 6,000-Mc Radio Relay. J. P. Laico, H. L. McDowell, and C. R. Moster. *Bell System Technical Journal*, v. 35, Nov. 1956, p. 1285-1346.

Design and performance data for traveling-wave amplifier which gives 30 decibels of gain of 5 w. output in the 5,925- to 6,425-Mc. common carrier band.

3834 Helix Waveguide. S. P. Morgan and J. A. Young. *Bell System Technical Journal*, v. 35, Nov. 1956, p. 1347-1384.

Properties of waveguide composed of closely wound turns of insulated Cu wire covered with a lossy jacket. Approximate formulas for propagation constants of the lossy modes.

3835 Wafer-Type Millimeter Wave Rectifiers. W. M. Sharpless. *Bell System Technical Journal*, v. 35, Nov. 1956, p. 1385-1402.

A wafer-type Si point-contact rectifier and holder designed primarily for use as the first detector in mm. wave receivers. Methods of estimating values of the circuit parameters of a point-contact rectifier.

3836 Frequency Conversion by Means of a Nonlinear Admittance. C. F. Edwards. *Bell System Technical Journal*, v. 35, Nov. 1956, p. 1403-1416.

Mathematical analysis of a hetorodyne conversion transducer in which the nonlinear element is made up of a nonlinear resistor and a nonlinear capacitor in parallel.

3837 Minimization of Boolean Functions. E. J. McCluskey, Jr. *Bell System Technical Journal*, v. 35, Nov. 1956, p. 1417-1444.

A systematic procedure for writing a Boolean function as a minimum sum of products.

3838* Color Television. G. N. Patchett. *British Institution of Radio Engineers, Journal*, v. 16, Nov. 1956, p. 591-620.

Theory of color mixing and of colorimetry. Various systems for color television. Studio and receiver equipment.

3839 The Suppression of Screen Grid Emission by Carbon. J. A. Champion. *British Journal of Applied Physics*, v. 7, Nov. 1956, p. 395-399.

The emission level obtained in a receiving valve in which there is no suppression is of the same magnitude as that of a thin activated layer of BaO. Mechanism by which C suppresses emission is the chemical reduction of deposited BaO to Ba which then evaporates.

3840* Radio Relay Equipment Employing Pulse-Modulated Microwaves. H. Paul. *Brown Boveri Review*, v. 43, no. 9, Sept. 1956, p. 344-351.

Review of the various modulation systems employed in radio relay equipment. Method of operation of sets using the time-division multiple system. Description of R.F. transmitter and receiver.

3841* Measures to Increase the Reliability of Radio Relay Links. I. Wigdorovits. *Brown Boveri Review*, v. 43, no. 9, Sept. 1956, p. 361-368.

Sources, recognition, and methods of preventing faults.

3842* The Problem of Cross-Talk in Frequency-Modulated Radio Relay Equipment for Small Numbers of Channels. I. Wigdorovits. *Brown Boveri Review*, v. 43, no. 9, Sept. 1956, p. 384-393.

Causes of cross-talk and its dependence on various quantities. Calculation of the cross-talk ratio by a combined graphical and numerical method, with the aid of a concrete example.

3843 Electron-Phonon Equilibrium and the Transport Phenomena in Metals at Low Temperatures. E. H. Sondheimer. *Canadian Journal of Physics*, v. 34, Suppl. no. 12A, Dec. 1956, p. 1246-1255.

Phonon-phonon scattering; scattering by conduction electrons and by point imperfections; boundary scattering.

3844 A General Expression for the Conductivity Tensor. R. Kubo. *Canadian Journal of Physics*, v. 34, Suppl. no. 12A, Dec. 1956, p. 1274-1277.

3845 Heat Transfer in Semiconductors. A. F. Joffé. *Canadian Journal of Physics*, v. 34, Suppl. no. 12A, Dec. 1956, p. 1342- 1355.

Electric and the thermal behavior in the temperature range between −100 and +500 C.

3846 On the Transition to Metallic Conduction in Semiconductors. N. F. Mott. *Canadian Journal of Physics*, v. 34, Suppl. no. 12A, Dec. 1956, p. 1356-1368.

The conductivity to be expected from a crystalline array of atoms when the interatomic distance is varied.

3847 Galvanomagnetic Effects in *n*-Type InSb at 4.2° K. H. P. R. Frederikse and W. R. Hosler. *Canadian Journal of Physics*, v. 34, Suppl. no. 12A, Dec. 1956, p. 1377-1378.

3848 Automatic Protection Switching for TD-2 Radio System. G. H. Klemm. *Communication and Electronics*, Nov. 1956, p. 520-527.

Circuits and operation of switching equipment.

3849 Southwest Oregon Radio System for the Bonneville Power Administration. D. J. Marihart and D. L. Wylie. *Communication and Electronics*, Nov. 1956, p. 531-538.

Communications requirements; point-to-point microwave links; field surveys; system design; equipment specifications; installation; operation.

3850 Microwave for Telephone Companies. W. C. Fisher. *Communication and Electronics*, Nov. 1956, p. 538-542.

Basic requirements; transmission quality and performance; reliability; compatibility; engineering and installation services; statistics on typical microwave systems.

3851 Magnetic Amplifier Control of Switching Transistors. H. William Collins. *Communication and Electronics*, Nov. 1956, p. 585-589.

Magnetic elements serve both as a pulse-width modulator and as a high-gain preamplifier, thereby producing an amplifier with high-gain as well as high-output power.

3852 The Triductor. Paul P. Biringer. *Communication and Electronics*, Nov. 1956, p. 590-594.

Properties, basic equations, and practical applications of the d.c. premagnetized frequency tripler or triductor.

3853 Synchronization Accuracy Obtainable With Multiplier Phototubes. Leo Levi. *Communication and Electronics*, Nov. 1956, p. 603-606.

Analysis of jitter in multiplier phototube synchronization systems. Effect of bandwidth, phototube, and optical parameters.

3854 Impedance of Thin-Wire Loop Antennas. James E. Storer. *Communication and Electronics*, Nov. 1956, p. 606-619.

3855 Diode-Shunting in Magnetic Amplifiers. J. L. Lowrance and J. D. Dolan. *Communication and Electronics*, Nov. 1956, p. 619-624.

An analysis of the bias currents in two different circuit arrangements. Feedback effects.

3856* (French.) The Decline of Thermionic Emission of Cathodes With Alkaline-Earth Oxides and With Thorium Oxide Under Impulse Conditions. **Le déclin de l'emission thermionique des cathodes à oxydes alcalinoterreux et à oxyde de thorium en régime d'impulsions.** Guy Mesnard and Robert Uzan. *Comptes Rendus*, v. 243, no. 2, Nov. 12, 1956, p. 1502-1504.

A decline was observed with thoria cathodes. Influence of temperature. Comparison of results from cathodes with alkaline-earth oxides.

3857 The Effect of Air Exposure on Various Cathodes for Demountable Vacuum Systems. G. A. Haas and J. T. Jensen, Jr. 9 p. 1956. Naval Research Laboratory, Washington, D. C. (T21 Un3.5n Contin.)

Studies with various Ni-matrix and W-matrix cathodes indicate that the standard oxide cathode shows most promise as an electron emitter if the flaking problem can be controlled.

3858 Television—A Military Intelligence and Communications Medium. Norman Gray and J. C. Jangarathis. *Electrical Engineering*, v. 75, Dec. 1956, p. 1069-1074.

Some of the proposed applications for military television in combat; types of current interim mobile television units; recent maneuver utilization of two units.

3859 Power Company Microwave Communications System. G. D. Perry, Jr. and Eugene Langone. *Electrical Engineering*, v. 75, Dec. 1956, p. 1075.

Microwave channels and their operation.

3860 Theory of Dynamic Quenching of Photoconductivity and Luminescence. Frank Matossi. *Electrochemical Society, Journal*, v. 103, Dec. 1956, p. 662-667.

A mathematical description of the dynamic quenching in terms of a simplified model of the energy levels and transitions in a semiconductor. Approximate formulas for computing the numerical values of the parameters from characteristic features of the dynamic quenching curves.

3861 Cathode-Follower Type Power Supplies. B. J. Perry. *Electronic Engineering*, v. 28, Dec. 1956, p. 517-520.

Use of triode valves as rectifiers in variable-voltage power supplies. Comparison with simple series stabilizer. A practical circuit used in electrophoresis applications and based on a combination of these circuits.

3862 Microwave Measuring Devices. H. H. Klinger. *Electronic Engineering*, v. 28, Dec. 1956, p. 524-527.

Principles and characteristics of microwave measuring devices for radio link systems, particularly devices required for developing, testing, installing, and monitoring link systems.

3863 The Design of Cold-Cathode Valve Circuits. III. J. E. Flood and J. B. Warman. *Electronic Engineering*, v. 28, Dec. 1956, p. 528-532.

Gating circuits using diodes; diode trigger and counter circuits; miscellaneous diode applications; multi-cathode valve circuits; equipment using cold-cathode valves.

3864 Efficiency-Diode Line Scanning Circuits. A Simplified Design Method. K. G. Beauchamp. *Electronic Engineering*, v. 28, Dec. 1956, p. 533-535.

3865 Resistance - Capacitance Tuned Amplifiers Using Negative Feedback. D. J. O'Connor. *Electronic Engineering*, v. 28, Dec. 1956, p. 536-539.

3866 A High Speed Oscillograph Cathode-Ray Tube for the Direct Recording of High Current Transients. R. Feinberg. *Electronic Engineering*, v. 28, Dec. 1956, p. 540-541.

3867 How to Design Colpitts Crystal Oscillators. H. E. Gruen. *Electronics*, v. 30, Jan. 1, 1957, p. 146-150.

Performance curves of output and crystal drive level allow performance prediction of circuits having a wide range of parameter values.

3868 Ferrite-Rod Antennas Operate in X-Band. Frank Reggia, E. G. Spencer, R. D. Hatcher, and J. E. Tompkins. *Electronics*, v. 30, Jan. 1, 1957, p. 159-161.

Radiation patterns show optimum design configuration of rod radiators for operation in the 9000-Mc. band.

3869 Thermistors Compensate Transistor Amplifiers. A. J. Wheeler. *Electronics*, v. 30, Jan. 1, 1957, p. 169-171.

Typical compensating circuits using thermistors, and equations for calculating component values.

3870 Silicon Diode Chopper Stabilizes D-C Amplifier. Lawrence Fleming. *Electronics*, v. 30, Jan. 1, 1957, p. 178-179.

Input impedance is 100 times greater than with Ge crystals.

3871 Electronics in Industry. George M. Chute. 2nd Ed. 431 p. 1956. McGraw-Hill, New York. (TK7815 C47e2)

Presents the basic fundamentals of electronic devices as needed in industry, and explains their use in practical communication circuits.

3872 Guide Manual of Cooling Methods for Electronic Equipment. 198 p. 1955. Bureau of Ships, Navy Department, Washington, D. C. (TK7870 C81g)

Design data to assist engineers without heat transfer backgrounds in the thermal design of miniaturized equipment.

3873 Handbook of Basic Circuits TV—FM—AM. Matthew Mandl. 365 p. 1956, MacMillan Co., New York. (TK7870 M31h)

An encyclopedic reference source of 136 fundamental electronic circuits.

3874 Handbook of Semiconductor Electronics. Lloyd P. Hunter, editor. Sections individually paged. 1956. McGraw-Hill, New York. (TK7872.S4 H91h)

A practical mannual covering the physics, technology, and circuit applications of transistors, diodes, and photocells.

3875 Heat Transfer in Miniaturized Electronic Equipment. 85 p. 1955. Bureau of Ships, Navy Department, Washington, D. C. (TK7870 C81h)

A survey of current thermal design methods and heat transfer techniques; some cooling techniques now under investigation.

3876 An Introduction to Single-Sideband Communications. J. F. Honey and D. K. Weaver, Jr. *I.R.E., Proceedings*, v. 44, Dec. 1956, p. 1667-1675.

The elements of the SSB communication system and its advantages over the AM system are discussed.

3877 Application of Single-Sideband Technique to Frequency Shift Telegraph. Christopher Buff. *I.R.E., Proceedings*, v. 44, Dec. 1956, p. 1692-1697.

3878 The Phase-Shift Method of Single-Sideband Signal Generation. Donald E. Norgaard. *I.R.E., Proceedings*, v. 44, Dec. 1956, p. 1718-1735.

A general expression is developed for sideband suppression obtained with the phase-shift method of single-sideband signal generation.

3879 Automatic Tuning Techniques for Single-Sideband Equipment. Vincent R. DeLong. *I.R.E., Proceedings*, v. 44, Dec. 1956, p. 1766-1774.

Methods of automatically positioning tuned circuits for rapid frequency changes.

3880 Stagger-Tuned Transistor Video Amplifiers. Victor H. Grinich. *Institute of Radio Engineers, Transactions on Broadcast and Television Receivers*, v. BTR-2, Oct. 1956, p. 53-56. (TK1 In6.6b Vis.)

Design equations.

3881 Analytical Approaches to Local Oscillator Stabilization. W. Y. Pan and D. J. Carlson. *Institute of Radio Engineers, Transactions on Broadcast and Television Receivers*, v. BTR-2, Oct. 1956, p. 57-64. (TK1 In6.6b Vis.)

The analytical approaches in general and the special considerations at U. H. F. are fully illustrated with two types of commercial television tuners.

3882 Synthesis of Tchebycheff Impedance-Matching Networks, Filters, and Interstages. George L. Matthaei. *Institute of Radio Engineers, Transactions on Circuit Theory*, v. CT-3, Sept. 1956, p. 163-172. (TK1 In6.6c Vis.)

3883 On Networks Without Ideal Transformers. Israel Cederbaum. *Institute of Radio Engineers, Transactions on Circuit Theory*, v. CT-3, Sept. 1956, p. 179-182. (TK1 In6.6c Vis.)

Conditions necessary for a matrix to represent a reciprocal, linear n port without ideal transformers. These express the physical property that such networks are incapable of voltage or current amplification at zero frequency, and are derived by studying the performance of purely resistive networks.

3884 High-Speed Flip-Flops for the Millimicrosecond Region. Z. Bay and N. T. Grisamore. *Institute of Radio Engineers, Transactions on Electronic Computers*, v. EC-5, Sept. 1956, p. 121-125. (TK1 In6.6e Vis.)

The problem of designing high-speed flip-flops was approached by dividing the circuit operation into steady-state and switching functions, the steady-state function being assigned to a slave flip-flop and the switching function to a driving circuit.

3885 Potentials Produced by an Eccentric Current Dipole in a Finite-Length Circular Conducting Cylinder. Robert H. Okada. *Institute of Radio Engineers, Transactions on Medical Electronics*, PGME-7, Dec. 1956, p. 14-19. (TK1 In6.6m Contin.)

The potential is obtained in the form of a double summation.

3886 Electronic Circuitry. Charles F. Kezer and Milton H. Aronson. *Instruments and Automation*, v. 29, Dec. 1956, p. 2410-2411.

Details of nonlinear capacitor which regulates 5-kv. power supply, gas-diode memory circuit, double-gas-diode memory circuit, and beam-power video driver amplifier.

3887 Introduction to Printed Circuits. Robert L. Swiggett. 101 p. 1956. John F. Rider Inc., New York. (TK7870 Sw56i)

Types of printed circuits encountered in electronic equipment; their characteristics and functions, how they are made, and their effects on the techniques for servicing devices that contain them.

3888 Lifetime Measurements of Excess Carriers on Semiconductors. N. J. Harrick. *Journal of Applied Physics*, v. 27, Dec. 1956, p. 1439-1442.

Technique whereby bulk carrier lifetimes in semiconductors can be measured over a wide range of injection level without making any electrical connections to the sample.

3889 Some Statistical Properties of Signal Plus Narrow Band Noise Integrated Over a Finite Time Interval. L. C. Maximon and J. P. Ruina. *Journal of Applied Physics*, v. 27, Dec. 1956, p. 1442-1448.

3890 Extremely Low-Frequency Electromagnetic Waves. I. Reception From Lightning. II. Propagation Properties. Leonard Liebermann. *Journal of Applied Physics*, v. 27, Dec. 1956, p. 1473-1483.

3891 Electromagnetic Transmission Characteristics of a Lattice of Infinitely Long Conducting Cylinders. Zohrab A. Kaprielian. *Journal of Applied Physics*, v. 27, Dec. 1956, p. 1491-1502.

3892 Reflectionless Transmission Through Dielectrics and Scattering Potentials. I. Kay and H. E. Moses. *Journal of Applied Physics*, v. 27, Dec. 1956, p. 1503-1508.

A complete solution for the problem of constructing a plane stratified dielectric medium having the property that at a fixed frequency and polarization a plane wave at any angle of incidence will be transmitted without reflection.

3893 Focusing of Low-Energy Electron Beams. W. W. H. Clarke and L. Jacob. *Journal of Applied Physics*, v. 27, Dec. 1956, p. 1519-1524.

Conventional electrostatic and magnetic lenses were used to focus electron beams in the range 30 to 70 v. Electron distribution was resolved by a series of concentric end collectors and a convention introduced to assess effective beam widths.

3894 Note on the Reduction of Carrier Lifetime in *p-n* Junction Diodes by Electron Bombardment. W. Miller, K. Bewig, and B. Salzberg. *Journal of Applied Physics*, v. 27, Dec. 1956, p. 1524-1527.

Time dependence of reverse transient current closely agreed with theory. Reciprocal of minority carrier lifetime was linear function of bombardment time. Bombardment also produced marked changes in static current-voltage characteristics of diodes.

3895 Stability of Periodic-Field Beam Focusing. K. K. N. Chang. *Journal of Applied Physics*, v. 27, Dec. 1956, p. 1527-1532.

Stability limit is determined by studying a perturbation of the obtained solution.

3896 Donor Concentration Changes in Oxide-Coated Cathodes Resulting From Changes in Electric Field. H. J. Krusemeyer and M. V. Pursley. *Journal of Applied Physics*, v. 27, Dec. 1956, p. 1537-1545.

3897 Backscattering for Arbitrary Angles of Incidence of a Plane Electromagnetic Wave on a Perfectly Conducting Spheroid With Small Eccentricity. Yasuto Mushiake. *Journal of Applied Physics*, v. 27, Dec. 1956, p. 1549-1556.

3898 Hydrogen as a Donor in Zinc Oxide. D. G. Thomas and J. J. Lander. *Journal of Chemical Physics*, v. 25, Dec. 1956, p. 1136-1142.

Hydrogen is found to diffuse into and increase the conductivity of single ZnO crystals. Diffusion rates and temperature and pressure dependencies of the quantity of H in the crystal were obtained.

3899 Properties of a Cadmium Sulfide Photorectifier. D. C. Reynolds, L. C. Greene, and L. L. Antes. *Journal of Chemical Physics*, v. 25, Dec. 1956, p. 1177-1179.

Device shows high resistance in both the forward and reverse directions in the dark. Under illumination considerable conductivity in the forward direction is observed. Mechanism of the cell is explained on the basis of a model involving formation of a quasi-intrinsic region by diffusion of the barrier into the crystal.

3900* Studies of Rectification in a Gas (Nitrogen) Discharge Between Coaxial Cylindrical Electrodes. I. Theory of Rectification in a.c. Silent Discharges. II. Rectification in Semiozonizers. V. L. Talekar. *Journal of Electronics*, v. 2, ser. 3, Nov. 1956, p. 205-238.

3901* On the Effect of the Transition Region Upon an Electron Beam Constrained by Brillouin Flow. B. W. Manley. *Journal of Electronics*, v. 2, ser. 3, Nov. 1956, p. 241-246.

In order to adjust the effect of the transition region in a valve designed for Brillouin flow the position of the beam throat will depend upon the extent of the transition region and the strength of the magnetic field.

3902* Anomalous Characteristics of Silicon Point Contact Rectifiers. D. J. Kyte. *Journal of Electronics*, v. 2, ser. 3, Nov. 1956, p. 247-258.

Following the application of a series of voltage pulses to p-type Si point contact rectifiers, anomalous reverse characteristics were observed. A tentative theory is put forward in terms of the production of electron traps in the Si lattice.

3903* The Measurement of Drift Mobility in Germanium at High Electric Fields. A. F. Gibson and J. W. Granville. *Journal of Electronics*, v. 2, ser. 3, Nov. 1956, p. 259-266.

A new technique in which the emitter and collector contacts of a conventional drift mobility specimen are replaced by a light spot and a section of suitable waveguide.

3904* Elastoresistance and Magnetoresistance in Multivalley Semi-Conductors With an Axis of Symmetry. Robert W. Keyes. *Journal of Electronics*, v. 2, ser. 3, Nov. 1956, p. 279-292.

A multivalley model of the energy bands of a crystal with an axis of 3,4, or 6 fold symmetry. The anisotropy in the properties of a single valley. Galvanomagnetic and elastoconductivity coefficients of the band.

3905 Linear Transient Analysis. Lumped-Parameter Two-Terminal Networks. Ernst Weber. v. I. 348 p. 1954. John Wiley & Sons, New York. (TK3226 W38L)

An extensive and critical review of classical and operational methods of analysis using the Laplace transform and Fourier integral methods.

3906* (French.) Properties of Elements of Germanium and Silicon. **Caractéristiques des éléments au germanium et au silicium.** M. Dugas. *Métaux, Corrosion-Industries*, v. 31, no. 375, Nov. 1956, p. 467-469.

Characteristics of point-contact and junction diodes, transistors, and phototransistors. Commercial applications.

3907* (German.) Properties and Applications of Junction Transistors. **Eigenschaften und Anwendung des Flächentransistors. I.** W. Rosenberg. *Nachrichtentechnik*, v. 6, no. 11, Nov. 1956, p. 492-495, 502.

Operating conditions of junction transistors in grounded base, grounded emitter, and grounded collector circuits. Determination of amplification, and input and output resistances.

3908 The Life and Reliability of Valves. K. Rodenhuis, H. Santing, and H. J. M. van Tol. *Philips Technical Review*, v. 18, no. 7, 1956-1957, p. 181-192.

Reliability is defined as the reciprocal of the failure rate. A useful life of 10,000 hrs. and a failure rate of 0.5% per 1,000 hrs. have been reached with "special quality" type tubes.

3909 Longitudinal Magnetoresistance in the Quantum Limit. P. N. Argyres and E. N. Adams. *Physical Review*, v. 104, ser. 2, Nov. 15, 1956, p. 900-908.

For a nondegenerate semiconductor and in the ionized impurity scattering range a negative magnetoresistance is predicted.

3910 Properties of Silicon Doped With Manganese. R. O. Carlson. *Physical Review*, v. 104, ser. 2, Nov. 15, 1956, p. 937-941.

Hall mobility method shows the presence of electron traps. Heating to only 200 to 300 C causes the precipitation of the Mn and loss of electrical activity.

3911 Thermoelectric Power of Gray Tin. A. N. Goland and A. W. Ewald. *Physical Review*, v. 104, ser. 2, Nov. 15, 1956, p. 948-953.

The measured power of *p*-type samples is analyzed into electronic and phonon contributions with Hall and electrical conductivity data.

3912 Theory of Transport Effects in Semiconductors: Thermoelectricity. P. J. Price. *Physical Review*, v. 104, ser. 2, Dec. 1, 1956, p. 1223-1239.

The phenomenological theory of the thermoelectric effects in a cubic or isotropic electronic conductor is developed. It is shown that, as a consequence of the appropriate Onsager relation, the gage adopted here for the thermoelectric coefficients of a single substance is such that the second K relation takes a specially simple form for a single substance.

3913 Rate Limitation at the Surface for Impurity Diffusion in Semiconductors. F. M. Smits and R. C. Miller. *Physical Review*, v. 104, ser. 2, Dec. 1, 1956, p. 1242-1245.

When a rate limitation exists at the surface for impurity diffusion in semiconductors, the appropriate boundary condition is equivalent to the radiation boundary condition for the conductance of heat in solids. The intentional introduction of an additional external rate limitation allows the measurement of partition coefficients.

3914 Conduction Band Structure of Germanium-Silicon Alloys. Maurice Glicksman and Schuyler M. Christian. *Physical Review*, v. 104, ser. 2, Dec. 1, 1956, p. 1278-1279.

Previous measurements of the magnetoresistance and Hall effect in *n*-type Ge-Si alloy single crystals were extended to higher Si compositions. These observations at room temperature show that in alloys with Si content greater than 23%, the electronic conduction takes place in energy minima which are spheroids oriented along the [100] axes in the reduced zone.

3915 The Statistics of Charge Carrier Fluctuations in Semi-Conductors. R. E. Burgess. *Physical Society, Proceedings*, v. 69, no. 442B, Oct. 1956, p. 1020-1027.

The statistical fluctuations in the number of charge carriers (conduction electrons or valence band holes) in a given vol. of semiconductor in the steady state is calculated from the transition probabilities of electrons between the conduction and valence bands or between either band and impurity levels.

3916 The Scattering of Electromagnetic Waves by Conducting Spheres and Discs. J. S. Hey, G. S. Stewart, J. T. Pinson, and P. E. V. Prince. *Physical Society, Proceedings*, v. 69, no. 442B, Oct. 1956, p. 1038-1049.

A laboratory method is described for measuring the returned signal scattered from an object in an electromagnetic field. Measurements on conducting spheres and discs are compared with theoretical formulas.

3917 Principles of Electronics and Electronic Systems. J. L. Daley. 492 p. 1956. United States Naval Institute. (TK 7815 D15p)

Text for a survey course in electronics at the undergraduate college level. A general reference for others with an engineering interest in the field of electronics.

3918* (English.) **Energy Loss of a Charged Particle Traversing Superconductors.** Satio Hayakawa and Kazuo Kitao. *Progress of Theoretical Physics*, v. 16, Aug. 1956, p. 131-138.

Loss is calculated by taking into account the London equations of superconductivity.

3919 Pulse and Digital Circuits. Jacob Millman and Herbert Taub. McGraw-Hill Electrical and Electronic Engineering Series. 687p. 1956. McGraw-Hill, New York. (TK7835 M62p)

Describes and analyzes circuits and techniques common to many of the newer fields of electrical engineering including

pulse amplifiers, multivibrators, time-base generators, delay lines, counting, computer circuits, and transistor techniques.

3920 Electronic Devices for Nuclear Physics. A Report on Photomultiplier Tube Development. M. H. Greenblatt, R. M. Matheson, A. H. Sommer, and G. O. Fowler. *RCA Laboratories, David Sarnoff Research Center (U. S. Atomic Energy Commission)*, RIB-17, Nov. 1956, 13 p. (UF767 Un3.1ri Contin.)

Time-resolution measurement of existing multiplier structures and photocathode first dynode system; multiplier structures with improved time resolution; studies of collection efficiency.

3921 A Miniature Vidicon of High Sensitivity. A. D. Cope. *RCA Review*, v. 17, Dec. 1956, p. 460-468.

Characteristics of an experimental miniature Vidicon tube which employs a new photoconductor layer of higher operating sensitivity than has previously been available. Adequate signal is generated with a scence illumination of 10-ft. candles and an f:1.9 lens to give a noise-free display.

3922 The Apparent Contact Potential of a Pseudo-Abrupt P-N Junction. Herbert Kroemer. *RCA Review*, v. 17, Dec. 1956, p. 515-521.

Mathematical analysis.

3923 A Video Automatic-Gain-Control Amplifier. John O. Schroeder. *RCA Review*, v. 17, Dec. 1956, p. 558-570.

Design and performance.

3924* Lighting for Color Opaques on Television. H. N. Kozanowski. *Society of Motion Picture and Television Engineers, Journal*, v. 65, Nov. 1956, p. 606-607.

Various methods of obtaining adequate illumination for color are compared.

3925* (Russian.) Certain Problems of the Theory of Semiconductors and Dielectrics and Paths Toward Further Developments of the Theory. **Nekotorye voprosy teorii poluprovodnikov i dielektrikov i puti dal'neishego razvitiia teorii.** S. I. Pekar. *Uspekhi Fizicheskikh Nauk*, v. 60, no. 2, Oct. 1956, p. 191-212.

Phenomenological semiconductor theory. Kinetics of electrons in the zone of conductivity of semiconductors. Theory of thermal transition of electrons in semiconductors, and photo-transition of electrons.

See also: **3289** (reliability of electronic components); **3631** (chemical bond in semiconductors); **3691** (semiconductors as catalysts); **3734** (thyratron amplifiers); **3742** (electronic stroke-controlled die-cutter); **1410** (radio astronomy); **4021** (reflection of radio waves from ionosphere); **4063** (electronic speech writer); **4070** (electrolytic resistance recorder); **4098** (thyratron control circuit); **4299** (secondary electron emission of Ni alloys); **4406** (subminiature tubes); **4771** (Boolean algebra).

ENGINEERING ECONOMICS

3926 Amendments to Public Utility Holding Company Act, 1935. 498 p. 1956. United States Government Printing Office, Washington, D. C. (HD2766 Un3.27a)

Hearings before a subcommittee of the committee on interstate and foreign commerce, U. S. senate, on a bill encouraging development of low-cost electric energy from all sources of power.

3927* (French.) Mining Industry in Belgian Congo and in Ruanda-Urundi in 1955. **L'industrie minière du congo belge et du ruanda-urundi en 1955.** A. Vaes. *Annales des Mines de Belgique*, no. 6, Nov. 1956, p. 1000-1025.

The output for 1955 for the mines listed through these provinces is compared with 1954.

3928 Economics of Continuous Casting of Steel. L. G. Gegtyarev. *Henry Brutcher Translation No.* 3819, 3 p. (From *Stal'*, v. 16, no. 6, 1956, p. 558-559.) Henry Brutcher, Altadena, Calif.

Savings in changing from conventional to continuous casting process include decreased consumption of refractories, compressed air, and electricity.

3929 Cost Estimation in the Development of a New Process. J. A. Samaniego and C. R. Nelson. *Chemical Engineering Progress*, v. 52, Nov. 1956, p. 471-473.

3930 Criteria for Discontinuing Operating Investments. Norman W. Krase. *Chemical Engineering Progress*, v. 52, Dec. 1956, p. 495-499.

How to determine when a process facility has reached the point beyond which its continuation, in the light of other possibilities for investment of the capital involved, is unprofitable.

3931* (German.) German Chemical Industry Weighed in the Balance Sheets. **Deutsche chemiewirtschaft im Spiegel der Bilanzen.** Hermann Staiger. *Chemische Industrie*, v. 8, no. 11, Nov. 1956, p. 587-591.

An economic evaluation.

3932 Company Practices in Marketing Research. Richard D. Crisp. 63 p. 1953. American Management Assn., New York. (HD28 Am35r Vis.)

A survey of current practices and policies; what marketing research can do; trends in expenditures.

3933 Economic Survey of Europe in 1955, Including Studies of Investment Problems and Policies of European Countries and Labour Market Problems in Western Europe. 337 p. 1956. United Nations, Research and Planning Division, Economic Commission for Europe, Geneva. (HC240 Un2.2e Vis.)

3934 New Light on the Consumer Market. Irwin Friend and Irving B. Kravis. *Harvard Business Review*, v. 35, Jan.-Feb. 1957, p. 105-116.

New methods of determining market data; consumption patterns of various groups; market influences and their significance.

3935 Science and Truth in Marketing Research. Alfred Politz. *Harvard Business Review*, v. 35, Jan.-Feb. 1957, p. 117-126.

Reactions to stimuli are more important in the consumer survey than true opinions, attitudes, or preferences.

3936 Fuel Industries "Haven't Seen Anything Yet." Clyde Williams. *Heating, Piping & Air Conditioning*, v. 29, Jan. 1957, p. 150.

Our growing population and rising standard of living indicate a doubling of fuel and power consumption in the next 20 yrs. The potentialities for all fuels are great.

3937 The Economics of Atomic Power. S. M. Feinberg and S. A. Skvortsov. *Journal of Nuclear Energy*, v. 3, Nov. 1956, p. 383-396.

Reviews data from publications other than British. Includes costs of electricity, nuclear fuel, and atomic-power station equipment; economic steam conditions; ore procurement; and reactor types.

3938* Variety in Retailing. William J. Baumol and Edward A. Ide. *Management Science*, v. 3, Oct. 1956, p. 93-101.

A first attempt at an analysis of the number of items stocked by a retailer and its relation to his sales, costs, and profits.

3939* Capital Equipment Analysis: The Required Rate of Profit. Myron J. Gordon and Eli Shapiro. *Management Science*, v. 3, Oct. 1956, p. 102-110.

3940 Our Trade With Canada. Its Impact on the United States' Economy. 17 p. 1956. Chamber of Commerce of the U. S., Washington, D. C. (HC106.5 C35o)

Geographical origin of U. S. exports to Canada.

3941 Petrochemical Developments—1956. *Petroleum Refiner*, v. 35, Dec. 1956, p. 131-207.

A look into the past and future for synthetic rubber, syndets, acrolein, butadiene, ammonia, LPG, and new industrial designs.

3942 Energy for Tomorrow—Inventory and Appraisal. John I. Yellott. *Power Engineering*, v. 60, Dec. 1956, p. 98 + 6 pages.

Review of resources demand and future trends in the U. S.

3943 Reports of Federal Reserve Consultant Committees on Economic Statistics. 722 p. 1955. U. S. Government Printing Office, Washington, D. C. (HA37 Un3.24r)

Hearings before the subcommittee on economic statistics of the joint committee on the economic report, congress of the U. S.

3944 Survey of Oils, 1956. v. XIV. 372 p. 1956. Maclean-Hunter, New York. (T12 C2p)

Review of active and inactive Canadian oil and gas companies. Production, export, import, and consumption statistics. Maps of oil and gas fields.

3945* (Swedish.) Fuel Supplies and Their Use in Power Production in Sweden. **Svenska bränsletillgongar och deras utnyttjning för kraftproduktion.** Erik Blomqvist and Folke Petri. *Teknisk Ukeblad*, v. 103, no. 43, Nov. 22, 1956, p. 986-990.

See also: **3698** (maintenance painting costs); **4172** (Co production statistics); **4235** (productivity of European foundries).

FLUID MECHANICS

3946 Wall Pressure Fluctuations in a Turbulent Boundary Layer. William W. Willmarth. *Acoustical Society of America, Journal*, v. 28, Nov. 1956, p. 1048-1053.

3947 Wave Propagation Through Fluid Contained in a Cylindrical, Elastic Shell. T. C. Lin and G. W. Morgan. *Acoustical Society of America, Journal*, v. 28, Nov. 1956, p. 1165-1176.

The dependence of the phase velocity as a function of frequency on four dimensionless parameters of the system is discussed and illustrated graphically.

3948 Small-Scale Acoustic Streaming in Liquids. Josef Kolb and Wesley L. Nyborg. *Acoustical Society of America, Journal*, v. 28, Nov. 1956, p. 1237-1242.

By using special acoustical and optical arrangements, vortex motions are discovered in the vicinity of small vibrating sources in liquids. Of particular importance is the vigorous eddying that typically takes place near a vibrating gas bubble when it rests on a boundary.

3949 Two-Phase Flow of Hydrogen in Horizontal Tubes. John D. Rogers. *A.I.Ch.E. Journal*, v. 2, Dec. 1956, p. 536-538.

Semirigorous equations are developed for flow of flashing liquids in pipe lines. These are applied to flow of H, and computed correlations are presented for the pressure drop and vapor fraction.

3950 Applied Mathematics and Mechanics. v. I. Gas Dynamics. Klaus Oswatitsch. (Translated from the German by Gustav Kuerti.) 610 p. 1956. Academic Press, New York. (QA930 Os9gtr)

Physical and technical problems of gas dynamics, with consideration of some fundamental experimental results.

3951 The Application of the Shock Tube to the Study of High Temperature Phenomena in Gases. A. Hertzberg. *Applied Mechanics Reviews*, v. 9, Dec. 1956, p. 505-509.

Historical development; aerodynamic testing; recent shock-tube studies in chemistry and physics.

3952* The One-Dimensional and Two-Dimensional Gas Dynamics Analogies. R. A. A. Bryant. *Australian Journal of Applied Science*, v. 7, Dec. 1956, p. 296-313.

A non-rectangular channel can be used only to give a mathematical analogy with a one-dimensional gas flow. A two-dimensional physical analogy between real water flow and ideal gas flow is justified only if motion of the gas is subsonic and isentropic.

3953 Effect of Fluid Motion on Interfacial Area of Dispersions. W. A. Rodger, V. G. Trice, Jr., and J. H. Rushton. *Chemical Engineering Progress*, v. 52, Dec. 1956, p. 515-520.

Interfacial area of drops formed by sheer stresses in turbulent fluid motion is related to a combination of equipment size, turbulence, and interfacial tension force factors.

3954* (French.) On the Rectilinear and Non-Stationary Movements of a Compressible Viscous and Heat Conductive Liquid. **Sur les mouvements rectilignes non stationnaires d'un fluide compressible visqueux et conducteur.** Henri Cabannes. *Comptes Rendus*, v. 243, no. 2, Nov. 12, 1956, p. 1482-1484.

A case is given for which the equations with partial derivatives of the movement are reduced to ordinary differential equations, the integration of which shows the influence of viscosity and thermal conductivity.

3955 Temperature Gradients in Turbulent Gas Streams. N. T. Hsu, Kazuhiko Sato, and B. H. Sage. *Industrial and Engineering Chemistry*, v. 48, Dec. 1956, p. 2218-2223.

Effect of flow conditions upon eddy conductivity.

3956* Fluid Flow and Heat Transfer in an Annulus With a Heated Core Tube. Henry Barrow. *Institution of Mechanical Engineers, Proceedings*, v. 169, no. 56, 1955, p. 1113-1124.

Fluid friction, velocity distribution, and heat transfer at the inner wall of a smooth concentric annulus in turbulent flow. Correlation of outer-wall friction factors and velocity data. A semi-theoretical equation for the heat-transfer coefficient.

3957 Selection of a Control Valve. C. S. Beard. *Instruments and Automation*, v. 29, Dec. 1956, p. 2412-2415.

Discussion of recommended specification sheet.

3958 Some Aspects of the Measurement of Oscillatory Hydraulic Flow Including Nonlinear Effects. Robert S. Wick. *Jet Propulsion*, v. 26, Dec. 1956, p. 1078-1083.

The basic parameter in nonsteady flowmetering is shown to be a nondimensional frequency defined as the Strouhal number. The errors due to neglecting inertial forces in the flowmeter model were calculated as a function of the Strouhal number.

3959 The Boundary Layer Inside a Conical Surface Due to Swirl. H. E. Weber. *Journal of Applied Mechanics*, v. 23, Dec. 1956, p. 587-592.

The momentum integrals of the boundary layer are derived, and both the laminar and turbulent boundary-layer solutions are obtained numerically.

3960 A Theory for Base Pressures in Transonic and Supersonic Flow. H. H. Korst. *Journal of Applied Mechanics*, v. 23, Dec. 1956, p. 593-600.

A physical flow model is devised based on the concepts of interaction between the dissipative shear flow and adjacent free stream and the conservation of mass in the wake.

3961 On the Torsional Oscillations of a Solid Sphere in a Viscous Fluid. G. F. Carrier and R. C. Di Prima. *Journal of Applied Mechanics*, v. 23, Dec. 1956, p. 601-605.

The first approximation to the circumferential velocity is computed, and then used in computing the first approximation to the pumping motion. This is used to compute the correction to the circumferential velocity and, in particular, the correction to the viscous torque.

3962 Properties of the Shock Transition at Low Temperature. J. J. Gilvarry. *Journal of Applied Physics*, v. 27, Dec. 1956, p. 1467-1472.

3963 Approximate Theory on the Stability of Interfacial Waves Between Two Streams. Chan-Mou Tchen. *Journal of Applied Physics*, v. 27, Dec. 1956, p. 1533-1536.

3964 Motion of the Interface Between Two Immiscible Liquids of Unequal Density in a Porous Solid. Ray E. Kidder. *Journal of Applied Physics*, v. 27, Dec. 1956, p. 1546-1548.

Motion is result of the force of gravity acting on the two liquids. Solution is obtained by direct potential theory methods.

3965* Forced and Free Axially-Symmetric Convection Produced by Differential Heating in a Rotating Fluid. H.-L. Kuo. *Journal of Meteorology*, v. 13, Dec. 1956, p. 521-527.

When the temperature gradient becomes higher than a certain upper limit, a more violent symmetric convection will occur.

3966 Edge Effects in Electromagnetic Flowmeters. J. A. Shercliff. *Journal of Nuclear Energy*, v. 3, Nov. 1956, p. 305-311.

Analysis of effects of currents which circulate in the moving fluid at the edges of the transverse magnetic field. These include loss of sensitivity, deformation of magnetic field, distortion of velocity profile, additional pressure loss across the flowmeter, and a corresponding force on the magnet poles.

3967 Free Convection in Narrow Vertical Liquid Metal Annuli. D. P. Timo. *Knolls Atomic Power Laboratory (U. S. Atomic Energy Commission)*, KAPL-M-DPT-8, Mar. 1955, 32 p. (UF767 Un3.1ka Contin.)

While made specifically for the case of convecting Na, this is applicable to other fluids, if film thermal resistances are considered.

3968 Quantitative Measurement of Gas Density by Means of Light Interference in a Schlieren System. Edward B. Temple. *Optical Society of America, Journal*, v. 47, Jan. 1957, p. 91-100.

3969* On the Calculation of Heat and Mass Transfer in Laminar and Turbulent Boundary Layers. I. The Laminr Case. II. The Turbulent Case. D. R. Davies and D. E. Bourne. *Quarterly Journal of Mechanics and Applied Mathematics*, v. 9, Dec. 1956, p. 457-488.

3970* The Flow of Cohesionless Grains in Fluids. R. A. Bagnold. *Royal Society of London, Philosophical Transactions*, v. 249, ser. A, no. 964, Dec. 1956, p. 235-297 + 1 plate.

Grain flow over a gravity grain bed; rate of grain transport; laminar fluid flow.

3971 Particle Motions in Sheared Suspensions; Orientations and Interactions of Rigid Rods. S. G. Mason and R. St J. Manley. *Royal Society, Proceedings*, v. 238, ser. A, Dec. 4, 1956, p. 117-131.

3972 Supersonic Inlet Diffusers and Introduction to Internal Aerodynamics. Rudolf Hermann. 378 p. 1956. Minneapolis-Honeywell Regulator Co., Minneapolis. (TL573 H42s)

Basic fundamentals of one-dimensional, two-dimensional wedge-type, and axisymmetric conical inlet diffusers for engineers working with inlets and control problems.

3973 Free-Stream Boundaries of Turbulent Flows. Stanley Corrsin and Alan L. Kistler. *U. S. National Advisory Committee for Aeronautics, Report* 1244, 1955, 32 p. (TL521 Un3r Vis.)

The instantaneously sharp and irregular front which is always found to separate turbulent fluid from contiguous "nonturbulent" fluid at a free-stream boundary is studied.

See also: **3736** (flow controller); **3744** (transient flow of compressible fluid); **4057** (heat transfer in rocket-motor gases); **4094** (anemometer calibration); **4119** (flow control valve); **4145** (hydraulic control valves).

FOOD TECHNOLOGY

3974 The Phosphorus Content of Refined Soybean Oil as a Criterion of Quality. R. E. Beal, E. B. Lancaster, and O. L. Brekke. *American Oil Chemists' Society, Journal*, v. 33, Dec. 1956, p. 619-624.

3975* (English.) **Antioxygenic Activity of α- and β-Glycerophosphoric Acids.** Chieko Urakami, Yoshiko Kakutani, and Hirotomo Okura. *Chemical Society of Japan, Bulletin*, v. 29, no. 8, Nov. 1956, p. 921-924.

3976 Plant Phospholipids. F. Aylward. *Chemistry & Industry*, no. 46, Nov. 24, 1956, p. 1360-1366.

Comprehensive literature review.

3977 The Commercial Production of Phospholipids and Their Uses in Foods. H. H. Hutt. *Chemistry & Industry*, no. 47, Dec. 1, 1956, p. 1409-1415.

3978 Termination Report. II. Food Irradiation and Associated Studies. *Columbia University (U. S. Atomic Energy Commission)*, NYO-3320, Apr. 1956, 77 p. (UF767 U3ny Contin.)

Covers factors affecting radiation sterilization and the design of processes; dosimetry, particularly for application to radiation sterilization, and application of radiation catalysis to chemical problems.

3979 Freeze-Dried Meat. III. Non-Oxidative Deterioration of Freeze-Dried Beef. IV. Factors Affecting the Rate of Deterioration. L. W. Regier and A. L. Tappel. *Food Research*, v. 21, Nov.-Dec. 1956, p. 630-649.

3980 Regeneration and Stability of Oxymyoglobin in Some Gamma Irradiated Meats. A. L. Tappel. *Food Research*, v. 21, Nov.-Dec. 1956, p. 650-656.

The radiation of meats containing metmyoglobin caused regeneration of oxymyoglobin.

3981* Measurement and Control of the More Difficult Process Variables. Wm. J. Scarlett. *Food Technology*, v. 10, Dec. 1956, p. 584-588.

Use of low-level nuclear radiation for various measurements; use of flow colorimeter; ultrasonic measurements.

3982* Recent Developments in Fruit and Vegetable Powder Technology. M. J. Copley, V. F. Kaufman, and C. L. Rasmussen. *Food Technology*, v. 10, Dec. 1956, p. 589-595.

Raw material requirements; addition of stabilizing elements; puff-drying techniques; incorporation of flavoring components; in-package desiccation; other methods of making powder; economic considerations.

3983* Effects of Gamma Radiation on the Pectic Constituents of Fruits and Vegetables. F. J. McArdle and J. V. Nehemias. *Food Technology*, v. 10, Dec. 1956, p. 599-601.

Relationship between radiation-induced softening of apple and carrot tissues and changes occurring in the pectic substances. Gamma radiation caused a decrease in protopectin and total pectic substances.

3984* Characteristics of Electron-Irradiated Meats Stored at Refrigerator Temperatues. J. F. Kirn, W. M. Urbain, and H. J. Czarnecki. *Food Technology*, v. 10, Dec. 1956, p. 601-603.

Evaluation of keeping qualities of irradiated meats from different species of animals and with different methods of processing.

3985* Effect of Ionizing Radiations on Carotenoid Stability. A. Lukton and G. Mackinney. *Food Technology*, v. 10, Dec. 1956, p. 630-632.

The destruction of carotenoid pigments on exposure to γ-radiation is caused by secondary reactions and depends upon the extent to which free radicals or peroxides formed in the surrounding medium are available for reaction.

3986 Antioxidant Analysis, Determination of Antioxidants in Edible Fats. Constance Anglin, J. H. Mahon, and Ross A. Chapman. *Journal of Agricultural and Food Chemistry*, v. 4, Dec. 1956, p. 1018-1022.

A statisfactory method was developed for determining butylated hydroxytoluene, butylated hydroxyanisole, propyl gallate, nordihydroguaiaretic acid, and all combinations except those containing the latter two compounds. Butylated hydroxyanisole and butylated hydroxytoluene are distilled off with superheated steam, and the distillate is analyzed using ferric chloride-2,2'-bipyridine and 2,6-dichloroquinonechloroimide. Nordihydroquaiaretic acid and propyl gallate are extracted from a CCl_4 solution of the fat using 50% ethyl alcohol and are determined using ferrous sulfate buffered to an appropriate pH.

3987 Antioxidants in the Food Industry. C. H. Lea. *Research*, v. 9, Dec. 1956, p. 472-478.

Deleterious changes caused by oxidation of certain foods; effective antioxidants and their application; pharmacological aspects of their use.

See also: **3348** (radiation sterilization).

FUELS AND COMBUSTION

3988 A New Coal Plastometer. Donald C. Hills. *ASTM Bulletin*, no. 218, Dec. 1956, p. 212TP-217TP.

New plastometer is less subject to bearing, slippage, and frothing troubles, and faster, more convenient, and more precise than the Gieseler.

3989* (French.) Gradual Coal Oxidation. **L'oxydation menagee du charbon.** A. F. Boyer. *Annales des Mines de Belgique*, no. 6, Nov. 1956, p. 908-912.

Study of a low cost oxidation of coal before coking, by heating near 300 C with oxidizing fumes in a fluidized bed.

3990* (French.) Studies on Fuel Briquet Coking in Germany. **Etudes sur la cokefaction des agglomeres en allemagne.** Wilhelm Reerink. *Annales des Mines de Belique*, no. 6, Nov. 1956, p. 916-922.

Practical experience in Germany in the coking of lean-coal and coal-and-ore briquets.

3991* (German.) Evaluation of m-p-Cresols From Coke and Low Temperature Carbonization Tars for Their Application in Production of Phenol-Formaldehyde Synthetic Resins. **Beurteilung von m-p-Kresol-Gemischen aus Kokerei- oder Schwelteeren von ihrer Verwendung zur Herstellung von Phenol Formladehyd-Kunstharzen.** Alfred Jäger and Günter Kattwinkel. *Brennstoff-Chemie*, v. 37, nos. 21-22, Nov. 1956, p. 371-372.

An improved method of analysis which meets the commercial requirements.

3992 Cost-Saving Techniques for Instrumenting a Fluidized Bed Pilot Plant. R. G. Minet and J. D. Mirkus. *Chemical Engineering Progress*, v. 52, Dec. 1956, p. 531-534.

Experience with a pilot plant for continuously carbonizing coal, for which the necessary control devices were selected and installed with minimum investment.

3993* (German.) New Vertical Ovens With Cooling Chambers at the Hague Gas Plant. **Neue Vertikal-Kühlkammeröfen auf dem Haager Gaswerk.** Eric Henri Berkhuijsen and Gerhard Lorenzen. *Gas- und Wasserfach*, v. 97, Ausgabe Gas, no. 21, Nov. 1956, p. 413-415.

Of particular interest in this plant are the fully automatic operation and the employment of a new-type elliptic stone recuperator.

3994* (German.) The Monclova (Mexico) Coking Plant. **Die Kokerei Monclova in Mexiko.** Wilhelm Fitz. *Gas- und Wasserfach*, v. 97, Ausgabe Gas, no. 21, Nov. 1956, p. 416-420.

A detailed description of this new plant is given.

3995 Visible Emission Spectra of Two-Stage Flames of Diethyl Ether Produced in Flat-Flame Burner. William G. Agnew and John T. Agnew. *Industrial and Engineering Chemistry*, v. 48, Dec. 1956, p. 2224-2231.

3996* Coal Breakage Processes. I. A New Analysis of Coal Breakage Processes. II. A Matrix Representation of Breakage. S. R. Broadbent and T. G. Callcott. *Institute of Fuel, Journal*, v. 29, Dec. 1956, p. 524-539.

Size distributions are described by vectors. Processes which alter size distributions, such as breakage processes and size classification, are represented by matrices multiplying the vectors. Complex processes may be analyzed by simple arithmetical procedures when matrices are used.

3997 Application of Probability Theory to Explosive-Ignition Phenomena. Ransom B. Parlin and J. Calvin Giddings. *Journal of Chemical Physics*, v. 25, Dec. 1956, p. 1161-1166.

Theory is applied to several cases of impact ignition of small explosive crystals, both with and without grit particles, and is found to be in good agreement with experiment.

3998 Stability and Burning Velocities of Laminar Carbon Monoxide-Air Flames at Pressures up to 93 Atmospheres. Rudolph Edse and William A. Strauss. *Journal of Chemical Physics*, v. 25, Dec. 1956, p. 1241-2145.

Burning velocities of CO-air flames decrease with rising pressure because the rate of diffusion of active particles into the unburned gas is reduced with pressure while no increase in heat transfer occurs.

3999 Sorption Studies on American Coals. Robert B. Anderson, W. Keith Hall, James A. Lecky, and Karl C. Stein. *Journal of Physical Chemistry*, v. 60, Nov. 1956, p. 1548-1558.

Pertinent information regarding pore structure is provided by density measurements and sorption isotherms of normal and isobutane at zero C and N isotherms at zero, −78, and −195 C.

4000* The Slow Oxidation of Gaseous Hydrocarbons. M. J. Ridge. *Reviews of Pure and Applied Chemistry*, v. 6, Sept. 1956, p. 121-152.

Gaseous hydrocarbons oxidize by free radical chain reactions. Delayed development of the rate is ascribed to process of branching via a comparatively stable intermediate.

4001* (Italian.) The Use of Natural Gas and the Evolution of the Town Gas Industry. **L'utilizzazione del gas naturale nei riflessi dell'evoluzione dell'industria del gas di città.** I. Giordano. *Rivista dei Combustibili*, v. 10, no. 10, Oct. 1956, p. 691-716.

A survey of new sources in view of the progressive conversion to methane distribution.

4002 Cool Flames in the Combustion of Toluene and Ethylbenzene. R. G. W. Norrish, F. R. S. Taylor, and G. W. Taylor. *Royal Society, Proceedings*, v. 238, ser. A, Dec. 18, 1956, p. 143-153.

Cool flames were observed in oxidation of both hydrocarbons between 300 and 500 C, but only ethylbenzene gave rise to a blue flame at higher temperatures.

4003 The Slow Combustion of Methyl Alcohol. A General Investigation. K. M. Bell and C. F. H. Tipper. *Royal Society, Proceedings*, v. 238, ser. A, Dec. 18, 1956, p. 256-268.

Pressure change was indicative of extent of reaction. Products were CO and water with small amounts of HCHO, H_2O_2, CO_2, and H_2. Oxidation may involve a chain mechanism with delayed branching.

4004 Cost Data for Gasification of Lignite in an Externally Heated Retort. O. C. Ongstad, M. H. Chetrick, and W. H. Oppelt. *U. S. Bureau of Mines, Report of Investigations* 5272, Nov. 1956, 17 p. (TN21 Un3r)

Cost data for the experimental unit. Estimate of synthesis-gas cost for a plant producing 50 million cu. ft. of (H_2+CO) per day, based on the production of cooled, tar- and dust-free raw synthesis gas.

4005 A Thermal Equation for Flame Quenching. A. E. Potter, Jr. and A. L. Berlad. *U. S. National Advisory Committee for Aeronautics, Report* 1264, 1956, 7 p. (TL521 Un3r Vis.)

Two possible rate-controlling reactions are postulated, and the resulting two quenching equations are tested using published data. If the oxygen-fuel reaction is assumed to be rate-controlling, quenching data are satisfactorily correlated for both rich and lean propane-oxygen-nitrogen flames.

4006 Effect of Concentration on Ignition Delays for Various Fuel-Oxygen-Nitrogen Mixtures at Elevated Temperatures. E. Anagnostou, R. S. Brokaw, and J. N. Butler. *U. S. National Advisory Committee for Aeronautics, Technical Note* 3887, Dec. 1956, 34 p. (TL570 Un3t)

Delays for mixtures of ethane, *n*-butane, isobutane, H, or propane with O and N were measured in the over-all range of 444 to 733 C using a flow system with two experimental procedures.

See also: **3945** (Swedish fuels); **4052** (ignition of solid propellants); **4188** (flue-gas corrosion).

GEOLOGY, GEOPHYSICS, MINERALOGY, AND MINING ENGINEERING

4007 Backscattering of Sound From the Sea Surface: Its Measurement, Causes, and Application to the Prediction of Reverberation Levels. R. J. Urick and R. M. Hoover. *Acoustical Society of America, Journal*, v. 28, Nov. 1956, p. 1038-1042.

4008 Acoustic Properties of the Ocean Bottom at Bahia Todos Santos, Lower California. C. W. Horton. *Acoustical Society of America, Journal*, v. 28, Nov. 1956, p. 1243-1247.

Analysis of transmission data shows that at a frequency of 200 c.p.s. the observed propagation agrees quite well with theory.

4009 Theory of the Shadow Zone Diffraction of Underwater Sound. William J. Noble. *Acoustical Society of America, Journal* v. 28, Nov. 1956, p. 1247-1252.

The problem of the shadow zone diffraction of underwater sound is reduced to that of diffraction by a dark half-plane and an asymptotic expansion of the edge wave used to calculate the transmission anomaly.

4010 The Development of Radio Astronomy. Gerald S. Hawkins. *American Scientist,* v. 45, Jan. 1957, p. 13-27.

The progress of a new science from its birth in 1932 to its present spectacular role in the realm of scientific discovery.

4011* (French.) Thin Seam Mining (50 cm. and less) With Steel Props at Romsée in the Wéritser Coal Mines. **Exploitation en couches minces (50 cm. et moins) avec étançons métalliques au siège de Romsée du charbonnage de Wérister.** P. Lemoine. *Annales des Mines de Belgique,* no. 6, Nov. 1956, p. 951-961.

A description of undercut caving with steel supports in two Belgian works. For thin seams with a slope of less than 30° this method is advantageous and safe. Scrapers were used to carry away coal.

4012* Two-Dimensional Aerial Smoothing in Radio Astronomy. R. N. Bracewell. *Australian Journal of Physics,* v. 9, Sept. 1956, p. 297-314.

Mathematical analysis.

4013* On the Association of Solar Radio Emission and Solar Prominences. J. P. Wild and H. Zirin. *Australian Journal of Physics,* v. 9, Sept. 1956, p. 315-323.

No close connection was found between limb events and radio events, but some eruptions were associated with simultaneous radio bursts.

4014* Ionospheric Reflections From Heights Below the *E* Region. J. B. Gregory. *Australian Journal of Physics,* v. 9, Sept. 1956, p. 324-342 + 2 plates.

From records of high absorption conditions during winter days, a connection between the decrease in strength of *E* region reflections and the increase in strength of partial reflections between approximately 66 and 88 km. is demonstrated.

4015* Cusp Type Anomalies in Variable Frequency Ionospheric Records. G. H. Munro and L. H. Heisler. *Australian Journal of Physics,* v. 9, Sept. 1956, p. 343-358.

Anomalous cusps which frequently appear at the H.F. end of ionosonde records of the F_2 region are explained as the result of modification of the ion distribution during the passage of typical travelling disturbances.

4016* The Theory of Strong Katabatic Winds. F. K. Ball. *Australian Journal of Physics,* v. 9, Sept. 1956, p. 373-386.

Development of theory from which various characteristics of the flow can be predicted, including intensity of the pressure jump and deviation of the wind from the lines of greatest slope caused by the earth's rotation.

4017* Statistical Analysis of Australian Pressure Data. S. C. Das. *Australian Journal of Physics,* v. 9, Sept. 1956, p. 394-399.

The mean high pressure belt is shown to be slowly moving southward.

4018* Turbodrills. Past and Present. J. H. Thacher and W. R. Postlewaite. *Drilling Contractor,* v. 13, Dec. 1956, p. 51-60.

Reviews latest information on the turbodrill available in both foreign and U. S. publications, and also from current field tests.

4019 General Relativity and Cosmology. G. C. McVittie. **The International Astrophysics Series, v. IV.** 198 p. 1956. John Wiley & Sons, New York. (QC6 M25g)

Tensor calculus and Riemannian geometry; Newtonian mechanics and special relativity; principles of general relativity; the Schwarzschild space-time; approximations to Einstein's equations and Newtonian gas-dynamics; model universes and the system of galaxies.

4020* Geochemistry of Iodine. Annotated Bibliography 1825-1954. 150 p. 1956. Chilean Iodine Educational Bureau, London. (Z5524.I4 C43g Ref.)

An annotated bibliography of 400 scientific papers containing quantitative or qualitative facts about the presence of I in rocks, minerals, and soils; tables of these data classified; a review summarizing and interpreting the findings.

4021* (English.) **The Focusing of Short Radio Waves Reflected From the Ionosphere.** J. D. Whitehead. *Journal of Atmospheric and Terrestrial Physics,* v. 9, Nov. 1956, p. 269-275.

Short-lived increases in the mean amplitude of waves reflected from the *F* region of the ionosphere are the result of focusing effects caused by large-scale distortions moving horizontally. Velocity of the movement can be determined from simultaneous observations of changes in amplitude and phase.

4022* (French.) The Bauxite Mines in the Var Section. **Les exploitations de bauxite du var.** Georges Vié. *Journal du Four Electrique,* v. 65, no. 5, Sept.-Oct. 1956, p. 159-161.

Geological location of five bauxite mines; description of the equipment, transportation facilities used, and the average output.

4023* Vorticity Distribution and Advection in the Lower and Middle Troposphere. Holbrook Landers. *Journal of Meteorology,* v. 13, Dec. 1956, p. 511-520.

Absolute-vorticity centers are advected at seven levels for six 12-hr. periods with use of mean observed winds.

4024* Forced and Free Meridional Circulations in the Atmosphere. H.-L. Kuo. *Journal of Meteorology,* v. 13, Dec. 1956, p. 561-568.

Form and intensity of these circulations are greatly influenced by the mean temperature distribution.

4025* Atmospheric Turbulent Diffusion From Infinite Line Sources. An Electric Analog Solution. Walter J. Karplus and James R. Allder. *Journal of Meteorology,* v. 13, Dec. 1956, p. 583-586.

A logarithmic wind profile and a linear eddy-diffusivity profile are assumed.

4026 Genetic Types of Economically Workable Uranium Deposits. D. Ya Surazhsky. *Journal of Nuclear Energy,* v. 3, Nov. 1956, p. 371-382.

General description of U deposits considering sources of the ore, character of structures which govern and localize the ore, content and physical properties of metalliferous solutions, and conditions for deposition of the metal.

4027 An Instrument for the Measurement of Salinity in Estuaries. E. G. Sandels. *Journal of Scientific Instruments,* v. 33, Nov. 1956, p. 424-428.

Electrical conductivity and temperature are measured and the salinity is computed readily from a nomogram.

4028* The Structures of the Plagioclase Felspars. VII. The Heat Treatment of Intermediate Plagioclases. P. Gay and M. G. Bown. *Mineralogical Magazine and Journal of the Mineralogical Society,* v. 31, Dec. 1956, p. 306-313.

The high-temperature structural forms have diffraction patterns which are characteristic of an albite-like structure.

4029* That New Drilling Fluid for Hot Holes. R. F. Burdyn and L. D. Wiener. *Mines Magazine,* v. 46, Nov. 1956, p. 139-142.

The first real test for new Ca surfactant muds in an oil well with temperatures of up to 410 F.

4030 New Mud Scores on Four Counts. J. L. Lummus and B. V. Randall. *Oil and Gas Journal,* v. 54, Dec. 10, 1956, p. 118-121.

New oil-base drilling mud can be economically mixed with rig equipment using either crude or refined oil. It has improved high-temperature stability, contamination resistance, and weight-suspending properties.

4031 Photometry of the Solar Aureole. Gordon A. Newkirk, Jr. *Optical Society of America, Journal,* v. 46, Dec. 1956, p. 1028-1037.

Equations governing the radiance of the sky at a specific wavelength and distance from the sun; graphs of the Mie scattering coefficient.

4032 The Origin and Nature of Ore Deposits. Robert Tunstall Walker and Woodville Joseph Walker. 384 p. 1956. Walker Associates, Colorado Springs. (TN263 W15o)

A practical book aimed at facilitating discovery and development of ore deposits by describing their physical and chemical characteristics, environment, and mode of formation.

4033* Recent Trends in Oil Geology. VI. Improved Logging Methods. J. C. M. Taylor. *Petroleum*, v. 19, Dec. 1956, p. 431-434, 448.

Review of advances in the methods available for obtaining sub-surface data from boreholes.

4034 Distribution in the Upper Atmosphere of Sodium Atoms Excited by Sunlight. T. M. Donahue, Robert Resnick, and V. Robert Stull. *Physical Review*, v. 104, ser. 2, Nov. 15, 1956, p. 873-879.

Calculations are made for a Na layer between 70 and 100 km.

4035 Proceedings of a Symposium on Astronomical Optics and Related Subjects. Zdeněk Kopal, editor. 428 p. 1956. Interscience Publishers, New York. (QB1 V66p)

Papers provide a forum for discussion of certain fields in optics of timely interest and astronomical significance and brings current astronomical desiderata to the attention of contemporary optical experts.

4036 Structural Geology. L. U. De Sitter. 552 p. 1956. McGraw-Hill, New York. (QE501 Si88s)

Intended for the trained geologist, this book is primarily concerned with systematizing our detailed knowledge so as to clarify genetic relationships. Characteristics of the largest structural units and theories of their origin are given.

See also: **3927** (mining industry of Belgian Congo); **3944** (Canadian oil fields); **3965** (convection in rotating fluid); **4094** (anemometer calibration); **4557** (mining of low-grade ores); **4559** (occurrence of U ores); **4769** (safety control of mine cables).

GRAPHIC ARTS

4037* Tests for Flexographic Inks. D. J. Bernardi. *Flexography*, v. 1, Nov.-Dec. 1956, p. 25, 50, 52.

Equipment and procedures for determining color, viscosity, drying time, and other properties.

4038 Formulary. Formulas for Solutions Used in Lithography. Robert F. Reed, compiler. 87 p. 1956. Lithographic Technical Foundation, New York. (NE2250 L71p Contin.)

Contains all of the published Lithographic Technical Foundation formulas that have stood the test of time.

4039 A New Vacuum Plate-Camera of Large Capacity. L. N. D. Lucas and P. B. Sewell. *Journal of Scientific Instruments*, v. 33, Dec. 1956, p. 465-467.

Camera for use in vertical-column type electron optical apparatus incorporates a new method of plate storage and selection which is very reliable in operation and makes large capacity and good pumping characteristics compatible with small volume.

4040 Large Perspectives Simplified. Victor Paquet, Glenn Dewey, and George Charron. *Machine Design*, v. 28, Dec. 13, 1956, p. 102-105.

A rapid method for drawing large perspectives, utilizing a mastersheet underlay which may be reused.

4041 Relation Between Granularity and Autocorrelation. A. Marriage and E. Pitts. *Optical Society of America, Journal*, v. 46, Dec. 1956, p. 1019-1027.

Concludes that the various methods of computing granularity as a function of the linear dimensions of the optical system all give the same information in different forms.

4042* Tone Reproduction in the Graphic Arts Processes. Warren L. Rhodes. *Pacific Printer, Publisher and Lithographer*, v. 95, Dec. 1956, p. 9 + 4 pages.

Tone reproduction characteristics of the major printing processes.

4043 Some Considerations on the Application of Photogrammetry for Small-Scale Cartography. H. Kasper. *Photogrammetric Engineering*, v. 22, Dec. 1956, p. 875-891.

Some instruments and methods recommended for economy, speed, and accuracy in such small scales as 1:200,000 and 1:300,000.

4044* Commercial Photography: Reducing Washing Times. George L. Wakefield. *Process*, v. 63, Dec. 1956, p. 483-484.

A "hypo clearing agent" used in the form of a bath following fixation permits final wash to be cut to 5 min. for plates and films and 8 min. for prints.

4045 Microdensitometer for Photographic Research. Joseph H. Altman and Keith F. Stultz. *Review of Scientific Instruments*, v. 27, Dec. 1956, p. 1033-1036.

Instrument has resolving power of 800 lines per mm. when scanning aperture is 1μ wide and 200μ long. By narrowing the aperture to 0.1μ, resolving power can be increased to 1800 lines per mm.

4046* Technical Opportunities in the 16mm and 8mm Fields. John A. Maurer. *Society of Motion Picture and Television Engineers, Journal*, v. 65, Nov. 1956, p. 586-590.

Reaction of the user to 16mm. professional film production; disadvantages of the negative-positive process; 16mm. cameras and projectors; film laboratory equipment and processing; electrical sound printing; projection lenses; possibilities of 8mm. film.

4047* Silver Soundtracks on a Reversal Color Print Film. Robert C. Lovick and Richard L. White. *Society of Motion Picture and Television Engineers, Journal*, v. 65, Nov. 1956, p. 591-593.

Methods of obtaining positive soundtracks on reversal color films. Requirements of negatives and copy negatives for soundtrack printing, exposure balance recommendations, and densitometry on Eastman Reversal Color Print Film, Type 5269.

4048* Scene-Change Cuing in Motion-Picture Printing. R. C. Lovick, J. M. Seemann, and J. G. Stott. *Society of Motion Picture and Television Engineers, Journal*, v. 65, Nov. 1956, p. 594-598.

The scene-change-cuing system described provides an extremely flexible method for cuing films to be printed by using either existing edge notches or applied conductive patches.

4049* First U. S. Installation of Arri Color Developing Equipment. Robert E. Johnson. *Society of Motion Picture and Television Engineers, Journal*, v. 65, Nov. 1956, p. 599-603.

Modern positive-negative color developing equipment and its operation.

4050* (Russian.) Using Electron-Optic Image Converters for Studying High Speed Phenomena. **Primenenie elektronnoopticheskogo preobrazovatelia dlia izucheniia bystroprotekaiushchikh iavlenii.** M. P. Vaniukov. *Uspekhi Fizicheskikh Nauk*, v. 60, no. 2, Oct. 1956, p. 295-326.

Electronic shutter and its application. Electron-optic strip photography and its utilization.

See also: **4097** (high-temperature camera adapter).

HEAT POWER

4051 The Problems of the Turbojet Engine as a Propulsion Engine for Supersonic Flight. M. J. Zucrow. *Aeronautical Engineering Review*, v. 15, Dec. 1956, p. 44-51, 61.

Effects of engine weight, performance, and combustion efficiency.

4052 Ignition of Solid Propellants by Forced Convection. S. W. Churchill, R. W. Kruggel, and J. C. Brier. *A.I.Ch.E. Journal*, v. 2, Dec. 1956, p. 568-571.

Experimental data for the ignition of single grains of solid propellant in a stream of gas at high temperature.

4053* (German.) Nomographs With Parallel Scales for Polytropic Changes of State. **Fluchtentafeln mit parallelen**

Leitern für polytropische Zustandsänderungen. W. Häussler. *Energietechnik*, v. 6, no. 11, Nov. 1956, p. 489-496.

Nomographs for compressors, diesel and steam engines. Use of nomographs for thermodynamic calculations.

4054 Re-Use of Steam Condensate as Boiler Feedwater. D. E. Noll and H. M. Rivers. *Industrial and Engineering Chemistry*, v. 48, Dec. 1956, p. 2146-2150.

Modern pretreating facilities, efficient deaerating equipment, proper materials of construction, devices for policing the system, and chemicals for conditioning steam make possible the effective re-use of condensate.

4055* Heat-Transfer Problems of Liquid-Cooled Gas-Turbine Blades. Henry Cohen and F. J. Bayley. *Institution of Mechanical Engineers, Proceedings*, v. 169, no. 53, 1955, p. 1063-1080.

Survey of possible methods of cooling turbine rotor blades. Thermo-syphon system, in which a quantity of liquid cooling is enclosed within each blade to act as a conveyor of heat to the more easily cooled root. Effectiveness was demonstrated in experiments using a rotating apparatus.

4056 The Use of Solid Propellant Engines for Achievement of Super Velocities. Joseph W. Wiggins. *Jet Propulsion*, v. 26, Dec. 1956, p. 1084-1087, 1090.

A review of the analytical relationships determining the velocity of a missile.

4057 Heat Transfer Between Solid Particles and Gas in a Rocket Nozzle. Peter L. P. Dillon and Lloyd E. Line, Jr. *Jet Propulsion*, v. 26, Dec. 1956, p. 1091-1097, 1090.

Method of calculations is illustrated with a C-H system containing eight parts of solid by weight, and the effect on specific impulse of the partial heat transfer is evaluated for a hypothetical rocket motor under specified conditions.

4058* Rocket Engine Reliability. A. G. Thatcher and H. A. Barton. *Ordnance*, v. 41, Jan.-Feb. 1957, p. 722-726.

A statistical approach can be applied to the reliability demonstration phase of a development program for liquid-propellant rocket engines even though the production quantities are small and testing costs high. k

4059 Ignition Delays and Fluid Properties of Several Fuels and Nitric Acid Oxidants in Temperature Range From 70° to —105° F. Riley O. Miller. U. S. National Advisory Committee for Aeronautics, *Technical Note* 3884, Dec. 1956, 32 p. (TL570 Un3t)

Ignition-delay characteristics of fuel-oxidant combinations with red- and white-fuming nitric acid, and a HNO_3-H_2SO_4 mixture were determined in a modified open-cup apparatus at —40 F.

4060 Thermodynamic Investigation of the Benzene Turbine Cycle. N. A. Beldecos and J. D. Lokay. *Westinghouse Electric Corporation, Atomic Power Division (U. S. Atomic Energy Commission)*, WIAP-M-24, July 1953, 28 p. (UF767 Un3.1wp Contin.)

Benzene is studied as a substitute for water in a reactor using liquid Na.

4061* (English.) **The Ramprop, a Supersonic Jet Driven Propeller.** Albert Gail. *Zeitschrift für Flugwissenschaften*, v. 4, no. 11, Nov. 1956, p. 341-355.

Structural and aerodynamic problems are analyzed and a suitable design is proposed.

See also: **3279** (aircraft-engine data); **4175** (heat-resisting steels for turbines).

INFORMATION—PREPARATION AND DISSEMINATION

4062 Phonetic Typewriter. Harry F. Olson and Herbert Belar. *Acoustical Society of America, Journal*, v. 28, Nov. 1956, p. 1072-1081.

Study of important factors and design of a simplified model.

4063 Linguistic Prerequisites for a Speech Writer. Yuen Ren Chao. *Acoustical Society of America, Journal*, v. 28, Nov. 1956, p. 1107-1109.

Deals with the phonetic and graphic aspects of the response and discrimination required of machine and the dictating person.

4064 When Engineers Go Public Speaking. Robert H. Emerick. *Air Conditioning, Heating, and Ventilating*, v. 54, Jan. 1957, p. 93-95.

Helpful hints for making a good speech.

4065 Manuscript Revision. Wendell M. Keck. *Chemistry in Canada*, v. 8, Dec. 1956, p. 42-44.

Checklist covering punctuation, grammar, and choice of words.

4066 Some of the Engineering Aspects of the Machine Translation of Language. Robert E. Wall, Jr. *Communication and Electronics*, Nov. 1956, p. 580-585.

Considers the general "state of the art" of the machine translation problem and some of the more promising methods of attack on individual problems.

4067 The Role of a Science Information Department in Industrial Research and Development. Henry C. Longnecker. *Journal of Chemical Education*, v. 33, Dec. 1956, p. 633-635.

Organization of the information department of Smith, Kline, and French laboratories; participation in research team activities; economic considerations.

4068 Using Dictation Equipment to Increase Engineering Output. A. N. Baxter. *Machine Design*, v. 28, Dec. 13, 1956, p. 94-99.

Characteristics of available equipment; advantages, problems, and applications.

4069 A Dictionary of Metallurgy. Ul-Vi. A. D. Merriman and J. S. Bowden. *Metal Treatment and Drop Forging*, v. 23, Dec. 1956, p. 487-494.

Definitions of terms from ultrabasite to Vialbra.

See also: **3821** (design of speech writing machine).

INSTRUMENTATION

4070* (English.) **Fast-Writing Precision Apparatus for Continuous Recording of Electrolytic Resistance.** Carl-Ove Andersson, Einar Stenhagen, and Olof Mellander. *Acta Chemica Scandinavica*, v. 10, no. 8, 1956, p. 1317-1326.

Full-scale response in less than 5 sec. is obtained for resistance-changes within a range variable at will from 2 to 1900 ohms.

4071 A Simple Apparatus for High Pressures and Temperatures. D. T. Griggs and G. C. Kennedy. American Journal *of Science*, v. 254, Dec. 1956, p. 722-735.

Apparatus provides pressures of 80 kb. at 500 C, 50 kb. at 800 C, and 20 kb. at 1000 C. Pressure is known within approximately 5%, and temperature to 5 C. The sample, in powdered form, is compressed between two pistons which are externally heated and pressed together by a hydraulic jack.

4072 Silicone Coating of Laboratory Ware. L. E. Bingenheimer, Jr. *American Pharmaceutical Association, Journal (Practial Pharmacy Ed.)*, v. 17, Dec. 1956, p. 797-799.

Silicone coating of graduates allows more accurate and rapid measurement by reducing adherence of aqueous liquids to the walls of the containers. Results, using syrup, glycerin, calamine lotion, and sulfonamide suspension, are presented.

4073* Method for Improving Sensitivity and Stability of an On-Off Temperature Control. A. Michels and D. Ritzke. *Applied Scientific Research*, v. 6, sec. B, no. 3, 1956, p. 137-143.

The usual inverse relationship between sensitivity and stability against outside influences can be improved by automatic variation of input potential at terminals of control heaters.

4074 Binoculars, Telescopes, and Telescopic Sights. Truman Henson. 515 p. 1955. Greenberg Publisher, New York. (QC373.06 H39b)

How they work and how to select, design, and build them.

4075 The Design of High Vacuum Systems and the Application of Kinney High Vacuum Pumps. C. M. Van Atta. 68 p. 1955. Kinney Manufacturing Division, New York Air Brake Co., Boston. (QC166 V26d)

4076 Metal Detector Finds Ducts and Pipes. Carl David Todd. *Electronics*, v. 30, Jan. 1, 1957, p. 172-174.

Search coil encased in Faraday shield is used as tank coil of transistor oscillator whose frequency shifts when coil comes near metal.

4077 A Projection Microphotometer for Quantitative Microscopy. R. C. Bostrom. *Institute of Radio Engineers, Transactions on Medical Electronics*, PGME-7, Dec. 1956, p. 20-28. (TK1 In6.6m Contin.)

Describes an instrument for easily obtaining the size and optical density of objects.

4078* Industrial Weighing With Load Cells. David Vandeventer. *ISA Journal*, v. 3, Dec. 1956, p. 492-495.

Examples emphasize successful applications to actual processes in situations involving impact, vibration, high-speed response, and portability.

4079 Uses of Carbon Replicas in Electron Microscopy. D. E. Bradley. *Journal of Applied Physics*, v. 27, Dec. 1956, p. 1399-1412.

The great strength and stability of C films obtained by vacuum evaporation make possible extremely thin specimens for high resolution work, chemical inertness permitting replication of almost any inorganic material. There are no problems of drift and film breakage and the films are easily seen. Both Formvar-carbon and directly stripped C replica techniques are invaluable in the electron microscopy of metals, especially with etched specimens. In many cases the film can be removed without destroying the specimen surface structure. The value of these techniques in biological applications is becoming increasingly apparent, but depends on extremely careful specimen preparation. Chemical and industrial applications include examination of photographic grains, small dense particles, oxide films, clays, coal, and fibers.

4080 An Electrical Indicator for a Mercury U-Tube Manometer. A. E. Hawkins. *Journal of Scientific Instruments*, v. 33, Nov. 1956, p. 412-414.

Metal limbs of U-tube act as outer conductors of two cylindrical capacitors. Tubes are coated internally with thin layer of dielectric material, and Hg acts as variable inner conductor.

4081 Simple Equipment for a Small Low Temperature Laboratory. R. F. Broom and A. C. Rose-Innes. *Journal of Scientific Instruments*, v. 33, Nov. 1956, p. 420-424.

Apparatus designed to use liquid He.

4082 A Kösters-Type Interferometer. C. F. Bruce. *Journal of Scientific Instruments*, v. 33, Dec. 1956, p. 478-482.

Design and performance of instrument which measures lengths of up to 500 mm. directly by interferometry.

4083 A Double-Beam Microspectrometer. G. H. Haggis. *Journal of Scientific Instruments*, v. 33, Dec. 1956, p. 491-493.

A modified single-beam spectrometer is fitted with a small rocking mirror to provide a double-beam through a reflecting microscope. Ratio of intensities of the two beams is determined electronically, and fed through to a pen recorder.

4084 Measurement of the Optical Density of Smoke in a Chimney. A. Littlewood. *Journal of Scientific Instruments*, v. 33, Dec. 1956, p. 495-499.

Device utilizes a double-beam, null-balancing system with a single light source and a single barrier-layer photoelectric cell.

4085 Fusion-Temperature Controls. W. S. Crocker and H. H. P. Lemmerman. *Machine Design*, v. 28, Dec. 13, 1956, p. 115-121.

Nature of the isothermal fusion process. Practical suggestions for the design of fusion-operated bellows actuators, temperature controllers, and constant-temperature baths.

4086 Accurate Linear Scales Ruled on a Grating Engine. David Richardson and Robert M. Stark. *Optical Society of America, Journal*, v. 47, Jan. 1957, p. 1-5.

An expression is obtained which permits the engine to be set to rule a scale with a desired spacing, accurate to within five p.p.m.

4087 Performance of an Eight-Inch Babcock Grating in a Large Vacuum Spectrograph. A. Keith Pierce. *Optical Society of America, Journal*, v. 47, Jan. 1957, p. 6-14.

Resolving power, vertical and horizontal instrumental profile; target pattern and blaze of grating; intensity of ghosts and scattered light.

4088 Ruling of Large Diffraction Gratings With Interferometric Control. George R. Harrison, Neville Sturgis, Stanley C. Baker, and George W. Stroke. *Optical Society of America, Journal*, v. 47, Jan. 1957, p. 15-22.

4089 High-Speed Wide-Range Fluorite Spectrograph. Chester J. Silvernail. *Optical Society of America, Journal*, v. 47, Jan. 1957, p. 23-26.

Design of a plane-grating spectrograph using a movable CaF_2 camera corrector lens. Camera focal ratio of $f/2$ gives the instrument a speed such that for relatively weak sources, exposure times have been reduced from several weeks to a number of hrs.

4090 Spectral Energy Calibration of a Light Flash Source Used in Physiological Experiments. Bent Buchmann-Olsen and Annelise Madsen Rosenfalck. *Optical Society of America, Journal*, v. 47, Jan. 1957, p. 30-34.

4091 New Principle for Focusing a High-Power Microscope and Means for Accomplishing the Focusing Automatically and With Great Accuracy. L. Baxter, II, J. DeYoung, R. C. C. St. George, and W. A. Shurcliff. *Optical Society of America, Journal*, v. 47, Jan. 1957, p. 76-80.

4092 Modulation of Radiant Energy From Incandescent Filaments. W. E. Tolles and L. C. Ihrig. *Optical Society of America, Journal*, v. 47, Jan. 1957, p. 101-102.

Ratio of modulation amplitude over the complete spectrum to that at a specific wavelength is proportional to the product of temperature and specific wavelength; hence a method of measuring temperature of an a.c. heated filament is obtained.

4093* (English.) **Effective Use of Radiation and Thermal Shields in a Vacuum Furnace.** Yoshikazu Ishikawa and Shozo Sawada. *Physical Society of Japan, Journal*, v. 11, no. 11, Nov. 1956, p. 1184-1190.

A method for calculating the efficiency of several sheets of thick radiation shields with finite thermal conductivity is presented.

4094* (English.) **A Device for Calibration of Anemometers for Air Flow of Low Velocities.** Yoshirō Omori. *Physical Society of Japan, Journal*, v. 11, no. 11, Nov. 1956, p. 1191-1200.

Description and operation.

4095 Clock-Escapement Mechanisms. T. K. Steele. *Product Engineering*, v. 28, Jan. 1957, p. 179-185.

Analysis of balance-wheel and run-away clock escapements; formulas, curves and typical applications including time devices, torque regulators, accelerometers, and velocity indicators.

4096 Intermediate-Image Pair Spectrometer. David E. Alburger. *Review of Scientific Instruments*, v. 27, Dec. 1956, p. 991-1004.

Design and performance of an iron-free intermediate-image β-ray spectrometer having a momentum spread for a point source of conversion electrons continuously variable between limits of 0.5 and 4% with corresponding transmissions of 1 and 8% of 4π, respectively.

4097 High-Temperature Adapter for X-Ray Powder Cameras. J. Fridrichsons. *Review of Scientific Instruments*, v. 27, Dec. 1956, p. 1015-1018.

Device can be attached to standard room-temperature cameras. Temperatures up to 1000 C can be obtained with power consumption of 10 w.

4098 Thyratron Circuit for Reliable Temperature Control. Norman A. Frigerio. *Review of Scientific Instruments*, v. 27, Dec. 1956, p. 1022-1024.

Instruments possess long life, high reliability, and low control power requirements. Simple phase shift circuits allow continuous control of system thermal hysteresis.

See also: **3448** (strip photometer); **3704** (viscometer); **4039** (electron-diffraction camera); **4597** (particle size measurement).

LUBRICATION AND FRICTION

4099* Friction of Steel Slabs on a Roller Table Under Varying Physical Conditions. S. K. Dean and M. A. Kilburn. *Institution of Mechanical Engineers, Proceedings,* v. 169, no. 54, 1955, p. 1081-1089.

4100 Measurement of Bearing Lubricant Films. W. E. Meyer, M. B. Purvis, and F. J. Villforth, Jr. *Instruments and Automation,* v. 29, Dec. 1956, p. 2416-2418.

Use of a differential transformer gage for determining film thickness, temperature, and pressure at any angular position.

4101 Application of Oil Mist Lubrication in the Steel Industry. T. M. Murphy. *Iron and Steel Engineer,* v. 33, Dec. 1956, p. 77-81.

Method has many advantages. For successful application oil must be kept clean and air lines supplying lubricated bearings must be clean and free of moisture. Lubricant requirements of the bearings must be within the capacity of the oil mist units.

4102 The Tapered-Land Thrust Bearing. C. F. Kettleborough. *Journal of Applied Mechanics,* v. 23, Dec. 1956, p. 581-583.

Maximum load capacity is about 14% greater than that carried by the tilting-pad bearing, side leakage being considered.

4103* On the Theory of Lubrication in Journal Bearings. Toshio Nishihara and Yutaka Sugimoto. *Kyoto University, Engineering Research Institute Technical Reports,* v. 6, no. 5, Aug. 1956, p. 75-97.

Analysis of pressure distribution in the oil film of the plain bearing of finite length; viscosity change due to change in temperature or pressure.

4104* Fundamentals of Wear. *Lubrication,* v. 42, Dec. 1956, p. 149-160.

Reviews the basic knowledge which has been developed in this field and discusses how it may be applied to the understanding of problems in lubrication, particularly of metal surfaces and liquid lubricants.

4105* The Mechanism of "Free" Rolling Friction. D. Tabor. *Lubrication Engineering,* v. 12, Nov.-Dec. 1956, p. 379-386.

A study of the mechanism of rolling friction in the elastic range suggests that the major source of "free" rolling friction is elastic hysteresis losses in the solids themselves.

4106 Study on New and Regenerated Motor Oils. A. B. Stern. *Research Council of Israel, Bulletin,* v. 5C, Mar.-June 1956, p. 157-170.

New and regenerated motor crankcase oils were compared by conventional test methods, constitutional analysis, and engine performance tests. Properly regenerated lubrication oils blended with suitable additives gave satisfactory results as motor lubricants.

4107* Molybdenum Disulfide as a Grease Additive. *Spokesman,* v. 20, Dec. 1956, p. 20 + 10 pages.

Properties of MoS_2; how it functions in grease; variables affecting performance.

4108* Some Aspects of Bentone Greases. R. E. Fariss. *Spokesman,* v. 20, Jan. 1957, p. 10-16.

Production of a Bentone-34 grease is related to method of preparation, oil used, type of mill employed, and whether or not dispersants are employed.

4109 Friction, Wear, and Surface Damage of Metals as Affected by Solid Surface Films. Edmond E. Bisson, Robert L. Johnson, Max A. Swikert, and Douglas Godfrey. *U. S. National Advisory Committee for Aeronautics, Report* 1254, 1956, 19 p. (TL521 Un3r Vis.)

Friction and surface damage of metal are reduced by solid surface films such as graphitic C, NiO, FeO, Fe_3O_4, FeS, $FeCl_2$, and MoS_2.

See also: **4273** (wear resistance of steel); **4397** (oil-less bearings).

MECHANICAL ENGINEERING

4110 Torsional Wave Propagation in Hollow Cylindrical Bars. S. K. Clark. *Acoustical Society of America, Journal,* v. 28, Nov. 1956, p. 1163-1165.

The characteristic equation governing the propagation of waves of pure torsion in a hollow cylindrical rod are developed, and values of the characteristic numbers governing the velocity of torsion wave propagation for the first five modes of motion are presented for both solid rods and various geometries of hollow cylindrical rods.

4111 (English.) **Distribution of the Surface Pressure Over the Friction Lining of Brakes With Rigid Shoes and Drums, and Efficiency of Such Brakes.** H. Schroder. *Acta Polytechnica (Mechanical Engineering Series),* v. 3, no. 8, 1956, 44 p. (T1 Ac81 Vis.)

4112* The Design of Intermediate Vertical Stiffeners on Web Plates Subjected to Shear. K. C. Rockey. *Aeronautical Quarterly,* v. 7, Nov. 1956, p. 275-296.

Presents details of an extensive series of tests conducted on stiffened web plates subjected to shear. Analysis of the results obtained from these tests show new empirical relationships between the flexural rigidity and spacing of the intermediate stiffeners and the buckling stress of the stiffened web plate.

4113* Photoelastic Investigation on Plates With Single Interference-Fit Pins With Load Applied to Plate Only. H. T. Jessop, C. Snell, and G. S. Holister. *Aeronautical Quarterly,* v. 7, Nov. 1956, p. 297-314 + 1 plate.

The introduction of an interference-fit pin in a circular hole in a flat plate results in a reduction in the stress concentration factor at the hole boundary under tension applied to the plate.

4114* Product Selection Guide. *Applied Hydraulics,* v. 10, Jan. 1957, p. 87-160.

Fluid power component selection charts include manufacturer, uses, characteristics, and other features.

4115* Stresses in Single-Span Deep Beams. F. E. Archer and E. M. Kitchen. *Australian Journal of Applied Science,* v. 7, Dec. 1956, p. 314-326.

Stress distribution in beams having a rectangular cross section, in which the thickness is small compared with the depth, is determined directly using strain-energy methods.

4116* The Failure of Thick-Walled Cylinders Under Internal Pressure. H. G. David. *Australian Journal of Applied Science,* v. 7, Dec. 1956, p. 327-335.

Tests with Ni-Cr-Mo steel cylinders subjected to internal pressures up to 12,000 atmospheres at room temperature confirm the Leinss empirical relation between yield pressure and tensile yield stress.

4117 The Frequency of Vibration and the Elastic Stability of a Fixed-Free Strip. R. F. S. Hearmon. *British Journal of Applied Physics,* v. 7, Nov. 1956, p. 405-407.

Suggestion that critical buckling loads can be found by estimating the load at which the frequency of vibration becomes zero is subjected to experimental test on fixed-free strips of boxwood, brass, and steel. Results show good agreement between load at zero frequency and critical load calculated from the Euler formula.

4118 Instability of Thin-Walled Cylinders Subjected to Internal Pressure. J. A. Haringx. *Henry Brutcher Translation No.* 3215, 11 p. (From *Ingenieur,* v. 63, no. 29, 1951, p. 39-41.) Henry Brutcher, Altadena, Calif.

Mathematical treatment of the possibility of buckling of thin-walled cylinders under internal pressure, especially elastic elements of reduced bending rigidity, such as round bellows.

4119 Modifying Valve Characteristics to Fit the Process. Gilbert L. Roth. *Control Engineering,* v. 4, Jan. 1957, p. 69-72.

Mechanism between actuator and valve modifies valve's characteristics to meet good flow control requirements.

4120* Myklestad's Method for Non-Uniform Vibrating Beams. II. R. E. D. Bishop. *Engineer,* v. 202, Dec. 21, 1956, p. 874-875.

Use of tabular calculation method for determining torsional vibration characteristics.

4121* (Russian.) Studying the Vibrations of High Speed Spindles. **Issledovanie vibratsii bystrokhodnykh vereten.** N. V. Zvinogrodskii and M. Ia. Kushul'. *Izvestiia Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk*, no. 10, Oct. 1956, p. 48-63.

Theory and practical set-up for studying vibration of a high speed spindle. Comparison of dynamic characteristics of solidly and elastically mounted bearings. Experiments indicate directions for improving operation and increasing speed.

4122 Three "Neutral" Loading Tests. S. S. Gill. *Journal of Applied Mechanics*, v. 23, Dec. 1956, p. 497-502.

Shear, axial, and circumferential strain were measured using hollow tubes of α-brass subjected to combined torsion and internal pressure.

4123 A Method for Determining the Flexural Effects of Statically Loaded Beams of Multiple Elastic Supports. R. A. Di Taranto. *Journal of Applied Mechanics*, v. 23, Dec. 1956, p. 503-508.

4124 The Effect of Shear on the Plastic Bending of Beams. D. C. Drucker. *Journal of Applied Mechanics*, v. 23, Dec. 1956, p. 509-514.

The lower-bound technique of limit analysis is used to find a safe relation between bending moment and shearing. The upper-bound technique of limit analysis is applied to the simple span and comparison made with the lower bound and the local criteria.

4125 Impulsive Loading of Elastic-Plastic Beams. J. A. Seiler, B. A. Cotter, and P. S. Symonds. *Journal of Applied Mechanics*, v. 23, Dec. 1956, p. 515-521.

The problem of a simply supported uniform beam of ductile material, subjected to impulsive loading such that the initial velocity is a half-sine wave.

4126 The Mathematical Analysis of Bow Girders of Any Shape. M. M. Abbassi. *Journal of Applied Mechanics*, v. 23, Dec. 1956, p. 522-526.

Exact and approximate formulas are given for symmetrical bow girders of any shape carrying a distributed load, or two equal concentrated loads, placed symmetrically with respect to the middle point of the girder.

4127 Thermal Stresses in Infinite Elastic Disks. Brahmadev Sharma. *Journal of Applied Mechanics*, v. 23, Dec. 1956, p. 527-531.

A direct method of solving problems of thermal stress in a disk of finite thickness and infinite radius.

4128 Influence of Large Amplitudes on Free Flexural Vibrations of Rectangular Elastic Plates. Hu-Nan Chu and George Herrmann. *Journal of Applied Mechanics*, v. 23, Dec. 1956, p. 532-540.

4129 On the Transmission of a Concentrated Load Into the Interior of an Elastic Body. G. L. Neidhardt and Eli Sternberg. *Journal of Applied Mechanics*, v. 23, Dec. 1956, p. 541-554.

An exact solution in series form for the stresses and displacements in an elastic body bounded by one sheet of a two-sheeted hyperboloid of revolution, subjected to an axial concentrated load at the vertex.

4130 On the Stresses in a Strip Under Tension and Containing Two Equal Circular Holes Placed Longitudinally. A. Atsumi. *Journal of Applied Mechanics*, v. 23, Dec. 1956, p. 555-562.

Theoretical analysis.

4131 Effect of Imperfections on Buckling of Thin Cylinders Under External Pressure. L. H. Donnell. *Journal of Applied Mechanics*, v. 23, Dec. 1956, p. 569-575.

4132 An Experimental Investigation of Beam Stresses Produced by Oblique Impact of a Steel Sphere. D. M. Cunningham and Werner Goldsmith. *Journal of Applied Mechanics*, v. 23, Dec. 1956, p. 606-611.

4133 The Influence of Blast Characteristics on the Final Deformation of Circular Cylindrical Shells. P. G. Hodge, Jr. *Journal of Applied Mechanics*, v. 23, Dec. 1956, p. 617-624.

Calculation of deformation of a reinforced circular cylindrical shell caused by a briefly applied, intense loading.

4134 Axisymmetrical Buckling of Circular Cones Under Axial Compression. Paul Seide. *Journal of Applied Mechanics*, v. 23, Dec. 1956, p. 625-628.

A simple expression is obtained for long cones of constant thickness, relating the cone buckling load to the buckling load of a long cylinder of equal thickness and the cone semivertex angle.

4135 Transient Response of a Nonlinear System by a Bilinear Approximation Method. E. I. Ergin. *Journal of Applied Mechanics*, v. 23, Dec. 1956, p. 635-641.

A line-segment approximation for a nonlinear elastic force makes it possible to obtain analytical solutions to a number of transient-load problems which formerly could be solved only by graphical or numerical methods.

4136 Three-Dimensional and Shell-Theory Analysis of Axially Symmetric Motions of Cylinders. George Herrmann and I. Mirsky. *Journal of Applied Mechanics*, v. 23, Dec. 1956, p. 563-568.

The frequency of axially symmetric free vibrations in an elastic, isotropic, circular cylinder of medium thickness is studied on the basis of the three-dimensional linear theory of elasticity and several different shell theories.

4137 A Rapid Method for Developing Cam Profiles Having Desired Acceleration Characteristics. Ray C. Johnson. *Machine Design*, v. 28, Dec. 13, 1956, p. 129-132.

4138 Column Design. Albert L. Gosman, Frank R. Campbell, and Richard P. Bobco. *Machine Design*, v. 28, Dec. 13, 1956, p. 137-139.

Chart gives transition points between Euler-Johnson formulas for analysis of intermediate-length columns.

4139 Designing Gray-Iron Castings. Arthur Scharf and Charles F. Walton. *Machine Design*, v. 29, Jan. 10, 1957, p. 104-122.

Comprehensive manual of basic methods and principles for design of low-cost parts in gray, alloy, and nodular cast iron.

4140* (English.) **Thin Circular Plates Under Certain Distributions of Normal Loading.** W. A. Bassali and R. H. Dawoud. *Mathematika*, v. 3, no. 6, Dec. 1956, p. 144-152.

Types of loading studied: a concentrated load at an arbitrary point; a line load spread on any part of a diameter; a load distributed over the area of a sector of the plate; a concentrated couple at an arbitrary point of the plate.

4141 Reducing Power Consumption in Hydraulic Circuits. Oswald S. Carliss. *Mechanical Engineering*, v. 78, Dec. 1956, p. 1110-1113.

Applied to a new fork-lift truck design.

4142 Minimum Weight Analysis of Compression Structures. George Gerard. 194 p. 1956. New York University Press, New York. (TL671.2 G31m)

Application of this analysis to increase efficiency in airframe design necessitated by supersonic speeds.

4143 Practical Solution of Torsional Vibration Problems. W. Ker Wilson. v. I. Frequency Calculations. 3rd Rev. Ed. 704 p. 1956. John Wiley & Sons, New York. (QA935 W69p3)

Frequency calculations and analyses of the characteristics of different types of oscillating systems. The effective inertia method for determining natural frequencies and its application in case of coupled vibration.

4144 Measurement and Control of Chatter in Gear Drives. C. E. Rose and G. F. Hadley. *Product Engineering*, v. 27, Dec. 1956, p. 168-171.

Gear drive chatter is analyzed with the Geiger Torsiograph. Equations are developed for computing speed variations and eccentricity. General recommendations are given concerning gear reducers and drive motors.

4145 Hydraulic Control Valves. 1. Relief Valves. John J. Pippenger. *Product Engineering*, v. 27, Dec. 1956, p. 174-181.

Identification, function, construction, installation, and maintenance.

4146 Speed-Torque Analysis for Rotating Mechanical Systems. V. H. Seliger. *Product Engineering*, v. 27, Dec. 1956, p. 184-186.

Systematic method for deriving and solving equations for speed and torque in an ideal rotating system.

4147 Some Suggestions for Research in Diaphragm Technology. F. H. Lyon and H. J. Grover. 12 p. 1956. American Society of Mechanical Engineers, New York. (TA350 L99s)

Extension of work on pressure-deflection response, anelastic effects, temperature behavior and fatigue of diaphragms is discussed from the design viewpoint.

4148 The Theory of Prestressed Concrete Design Statically Determinate Structures. Henry J. Cowan. 264 p. 1956. Macmillan & Co., New York. (TA439 C83t)

Covers assessment of losses, bending resistance of pretensioned sections, resistance to shear and torsion, deflection, and ultimate strength.

4149 Failure Characteristics of Pressurized Stiffened Cylinders. Roger W. Peters and Norris F. Dow. *U. S. National Advisory Committee for Aeronautics, Technical Note* 3851, Dec. 1956, 18 p. (TL570 Un3t)

Stiffened cylinders of 2024 and 7075 Al alloys, representative of fuselage construction, were tested under internal pressure and cyclic torsion. Fatigue cracks which developed in the skin resulted in both gradual and explosive types of failure.

See also: **3715** (automatic packaging equipment); **3750** (electronic-computer solution of vibration problems); **3957** (hydraulic control valve selection); **4099** (friction in roller conveyors); **4150** (light alloys in buses); **4707** (temperature, pressure, and fan design).

METALLURGY

4150* (German.) Henschel Omnibus, Type 160 USL. **Henschel-Omnibus Typ HS160 USL in Aluminium-Schalenbauweise.** H. Croseck. *Aluminium*, v. 32, no. 12, Dec. 1956, p. 769-777.

Advantages of light metal alloys in transportation equipment.

4151 Applied Metallurgy for Engineers. Malcolm S. Burton. 407 p. 1956. McGraw-Hill, New York. (TN665 B95a)

A college textbook presenting the elementary principles of metallurgy and their applications in the fields of casting, metal working, welding, heat treatment, and powder metallurgy for students in all branches of engineering.

4152* Stages in the Development of Industrial Metallurgy. F. T. M. White. *Australasian Engineer*, v. 49, Oct. 1956, p. 43-53.

An historical resumé of progress in metallurgy and metallurgical training.

4153* (German.) Radioactive Isotopes in Metallurgy and Metallography. **Radioisotope in Metallurgie und Metallkunde.** Traude Bernert. *Berg- und Hüttenmännische Monatshefte der Montanistischen Hochschule in Leoben*, v. 101, no. 11, Nov. 1956, p. 213-219.

Uses of radioactive isotopes in studies of diffusion, microstructure, wear and abrasion, Al casting, and routine tests.

4154* Bibliography of the Platinum Metals. 1941-1950. James Lewis Howe. v. III. 93 p. 1956. Baker & Co. Newark, New Jersey. (Z6679.P7 H83bv.3)

This third decennial bibliography of the Pt metals continues a survey beginning in 1748.

4155 A New Piston Ring Material. E. A. Sukhodol'skaya. *Henry Brutcher Translation No.* 3241, 8 p. (From *Liteinoe Proizvodstvo*, no. 2, Feb. 1953, p. 21-23.) Henry Brutcher, Altadena, Calif.

Studies of gray iron, alloy cast iron, and nodular irons.

4156 Development of Technical Ultrasonic Equipment for Metallurgical Applications, With Special Reference to the Sound Conduction Problem and the Electrodynamic Procedure. H. J. Seemann and H. Staats. *Henry Brutcher Translation No.* 3689, 21 p. (From *Giesseri Technisch-Wissenschaftliche Beihefte*, no. 14, 1954, p. 753-759.) Henry Brutcher, Altadena, Calif.

Effects of treating molten metals with ultrasonic energy; their significance for metallurgical applications.

4157 Defects and Failures of Metals. Their Origin and Elimination. E. P. Polushkin. 399 p. 1956. Elsevier Publishing Co., New York. (TA460 P76d)

A comprehensive and practical guide for engineers, metallurgists, and everyone concerned with producing fabricating, treating, testing, or inspecting metals and metal products.

4158* An Encyclopedia of the Iron and Steel Industry. A. K. Osborne, compiler. 558 p. Philosophical Library, New York. (TN705 Os2e)

A concise description of the materials, plant, tools, and processes used in the Iron and Steel Industry, and in those industries closely allied to it, from the preparation of the ore down to the finished product and definitions of the technical terms employed.

4159 Gold Processing. William Q. Hull and Cecil Stent. *Industrial and Engineering Chemistry*, v. 48, Dec. 1956, p. 2095-2106.

Mining; ore concentration; refining procedures.

4160 Creep-Resisting Steels. Study of 7 and 8% Cr Types for Steam Power Plant. M. G. Gemmill, H. Hughes, J. D. Murray, F. B. Pickering, and K. W. Andrews. *Iron & Steel*, v. 29, Dec. 1956, p. 614-623, 662-665.

Preparation, structure, and properties.

4161* (Hungarian.) Some Practical Examples on the Origin of Metallic Inhomogeneity of Steels. **Néhány gyakorlati példa az acélok fémes inhomogénitásának eredetére.** Lóránt Sass. *Kohászati Lapok*, v. 11, no. 9, Sept. 1956, p. 406-409.

Examples of the results of improper casting procedure or lack in preparation of molds.

4162* Investigation on Acid-Resistant High-Silicon Iron. II. Effects of Alloying Elements on Mechanical Properties, Corrosion Resistance and Shrinkage. Hiroshi Sawamura, Osamu Tajima, and Kyoichi Akamatsu. *Kyoto University, Memoirs of the Faculty of Engineering*, v. 18, no. 3, July 1956, p. 280-313.

Effects of Mn, P, S, Ni, Co, Cr, Mo, W, V, Ti, Al, Cu, Sn, and As.

4163 Manganese in the Iron and Steel Industry. Use—Recovery—Supplies. 45 p. 1953. Organisation for European Economic Co-operation, Paris. (Tn799.M3 Or3m)

Data on recovery and use of Mn in various European countries.

4164 Selecting Nickel Alloy Wire. David Schmid. *Materials & Methods*, v. 44, Dec. 1956, p. 100-105.

Detailed data and recommendations to help select the best wire for a specific application.

4165 How to Get More Out of Beryllium Copper. John T. Richards. *Materials & Methods*, v. 44, Dec. 1956, p. 112-114.

Data on how the properties of Be-Cu are influenced by such factors as Be content, rolled temper, aging temperature, heating rate during aging, metal thickness, and grain direction.

4166 Nickel Silvers. John L. Everhart. *Materials & Methods*, v. 44, Dec. 1956, p. 117-132.

Commercial grades, engineering properties, forming, machining, heat treating, joining, cleaning, finishing, and applications.

4167 Die Steel Useful for Ultra High-Strength Structural Requirements. John C. Hamaker, Jr. *Metal Progress*, v. 70, Dec. 1956, p. 93-96.

The strength, toughness, ductility and thermal stability of a 5% Cr die steel are superior to those of any ultra high-strength structural alloy proposed for aircraft operation in the temperature range of −100 to 1000 F.

4168 Fe-Al-Mo Alloys for High-Temperature Use. J. F. Nachman and W. J. Buehler. *Metal Progress*, v. 70, Dec. 1956, p. 107-110.

Light weight, excellent oxidation resistance and high strength at elevated temperatures indicate their potential utility as replacements for Fe-Cr and Fe-Cr-Ni alloys.

4169 Nomographic Charts of Pellets and Spheres. James B. Greeley. 20 p. 1956. Indium Corp. of America, Utica. (QC106 G81n)

A formula for determining the specific gravity of any alloy from the specific gravity of the constituents. Charts facilitating determination of weights and sizes of pellets and spheres made from metals and alloys.

4170* Classification of Contractors' Standards for the Procurement of Bureau of Aeronautics Aluminum and Magnesium Castings. E. L. Criscuolo and N. Modine. *Nondestructive Testing*, v. 14, Nov.-Dec. 1956, p. 28-31.

4171 A New Nickel-Free Stainless. E. J. Whittenberger, R. H. Witchey, and R. C. Rudolphy. *Product Engineering*, v. 27, Dec. 1956, p. 151-153.

In "Tenelon", a new austenitic stainless steel, Ni is replaced by Mn and N to give improved strength and satisfactory formability. It has good mechanical properties and high corrosion resistance in dilute acids.

4172* (French.) The Uses of Cobalt. **Les usages du cobalt.** M. Urbain. *Revue Universelle des Mines*, v. 12, ser. 9, no. 12, Dec. 1956, p. 621-630.

Growth of the world Co output from 1945 to 1955. Use in the production of refractory metals for gas turbines and rocket engines. Uses in ceramics and enameling. Fabrication of Co alloys by powder metallurgy. Properties of Co alloys.

4173 The Secondary Aluminium Industry in the U. S. A. 93 p. 1952. Organisation for European Economic Cooperation, Paris. (TS555 Or3s)

Report of a European mission on visits to U. S. scrap dealers, secondary smelters, foundries, and rolling mills.

4174* (Swedish.) Stainless Steel in Welded Structures. **Rostfria stål i svetsade konstruktioner.** Gunnar Larsson. *Svetsaren*, v. 21, no. 2, Sept. 1956, p. 17-23, 29-31.

A study of 18-8 steel in various phases of treatment for loss of carbides, corrosion resistance, and tensile strength in comparison with unalloyed steel. Application to various types of welded structures and pipe joints and flanges.

4175* (Russian.) Contemporary Trends in Development and Application of Heat-Resistant Materials in Turbine Construction. **Sovremennye tendentsii v razvitii i primenenii zharoprochykh materialov v turbostroenii.** P. B. Mikhailov-Mikheev. *Teploenergetika*, v. 3, no. 12, Dec. 1956, p. 3-10.

Comparative evaluation of austenitic and ferritic steels. Suggestions for improving properties of ferritic steels for use in turbines.

4176 Zirconium. Malcolm F. Judkins. *Wire and Wire Products*, v. 31, Dec. 1956, p. 1446-1449, 1506.

Historical background, refining, processing, and uses.

4177* (Russian.) Investigation of Alloy Systems Iron-Chromium-Nickel-Tungsten-Titanium-Aluminum. **Issledovanie splavov sistemy zhelezo-khrom-nikel'-vol'fram-titan-aliuminii.** V. S. Mikheev. *Zhurnal Neorganicheskoi Khimii*, v. 1, no. 9, Sept. 1956, p. 2110-2117 + 2 plates.

Preparation of alloys, microstructure, phase diagrams, and properties.

See also: **4069** (metallurgical dictionary).

METALS—CORROSION

4178* (German.) Scaling of Pure Iron, and Scaling in General. **Zur Kenntnis der Verzunderung von reinem Eisen und der Verzunderung im allgemeinen.** Norbert G. Schmahl, Hans Baumann, and Hermann Schenck. *Archiv für das Eisenhüttenwesen*, v. 27, no. 11, Nov. 1956, p. 707-713.

Experimental data of scaling of electrolytic Fe with O at 910 to 950 C.

4179 High-Temperature Oxidation of Titanium in Stream. G. P. Luchkin and G. G. Il'in. *Henry Brutcher Translation No.* 3830, 6 p. (From *Fizika Metallov i Metallovedenie*, v. 2, no. 3, 1956, p. 521-523.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 15754, v. 5, Dec. 1956.

4180 Effect of Hot Hydrogen Sulfide Environments on Various Metals. Frank J. Bruns. *Corrosion*, v. 13, Jan. 1957, p. 27-36.

Low Cr steels were satisfactory in the refinery provided the H_2S-H ratio is lower than 100 p.p.m. Aluminum coated steels showed marked resistance to attack with best results achieved with calorized coatings.

4181 High Temperature Sulfide Corrosion in Catalytic Reforming of Light Naphthas. Cecil Phillips, Jr. *Corrosion*, v. 13, Jan. 1957, p. 37-42.

Tests indicated that aluminized steel generally showed good resistance and that H_2S concentrations under 0.0008 mol.% did not cause appreciable damage at temperatures about 1000 F.

4182 Electrical Resistance Corrosion Measurements Employing Alternating Current. W. L. Denman. *Corrosion*, v. 13, Jan. 1957, p. 43-50.

Method is applicable to systems containing distilled water at room temperature, closed recirculating tap water at temperatures above 170 F, flowing return line condensate, and possibly to tubular material in service.

4183 Corrosion by High Purity Water. *Corrosion*, v. 13, Jan. 1957, p. 69-85.

A symposium covering corrosion of structural materials, corrosion engineering problems, and importance of high purity water data to industrial applications.

4184* (French.) The Electrochemical Basis of Corrosion. **Bases électrochimiques de la corrosion.** J. Brenet. *Corrosion et Anticorrosion*, v. 4, nos. 9-10, Oct.-Nov. 1956, p. 317-329.

A study of current opinions about corrosion as a phenomenon produced by electrochemical reactions.

4185 New Method of Studying Corrosion Inhibition of Iron With Sodium Silicate. E. F. Duffek and D. S. McKinney. *Electrochemical Society, Journal*, v. 103, Dec. 1956, p. 645-648.

Passivity curves taken on polished steel electrodes, pretreated for 24, or better, 48 hr. in aerated solutions of Na_2SiO_3 and compared with NaOH solutions of the same *p*H, indicate that silica, and not merely an increase in *p*H, caused inhibition.

4186 Corrosion of Steel Pipe by Savannah River Water. Fred Welty. *E. I. du Pont de Nemours & Co. (U. S. Atomic Energy Commission)*, DP-170, Aug. 1956, 15 p. (UF767 Un3.1dp Contin.)

Test sections of carbon steel pipe were pitted to a maximum depth of 0.06 in. during 30 months of exposure to flow of raw river water.

4187 Researches on Corrosion and Inhibition. Reaction Velocity in the System Iron: Dilute Acetic Acid at 40°C. II. Calculation of Reaction Velocity Constants and Fractional Surface Covered. George S. Gardner, Harry L. Faigen, Gregory L. Gibson, and Wilbur S. Hall. *Franklin Institute, Journal*, v. 262, Dec. 1956, p. 469-478.

4188 Control of Low Temperature Flue-Gas Corrosion. *Fuel Efficiency*, v. 4, Nov. 1956, p. 788-789, 791-792.

The introduction of a balanced quantity of gaseous ammonia into the flue gases was found to combat effectively the harmful action of SO_3.

4189 A Study of Heat Transfer Effects on Aluminum Corrosion. I. D. R. de Halas. *Hanford Atomic Products Operation (U. S. Atomic Energy Commission)*, HW-42585, Rev., Apr. 1956, 25 p. (UF767 Un3.1hw Contin.)

Data are given on the apparent thermal conductivity of the corrosion product film and the thickness of the film as a function of corrosion.

4190* (French.) The Tarnishing of Metals. **Le ternissement des metaux.** P. Huyskens. *Industrie Chimique Belge*, v. 21, no. 11, Nov. 1956, p. 1171-1192.

The action of O, S, and halogenes on metals gives rise to the formation of films which can follow linear, parabolic, or logarithmic laws.

4191* The Corrosion of Cargo Ships and Its Prevention. H. J. Adams and J. C. Hudson. *Institute of Marine Engineers, Transactions*, v. 68, Nov. 1956, p. 429-459.

Effects of steel quality, design, and various methods of protection. Corrosion of underwater plates, superstructure, and internal spaces. Remedial measures.

4192* Fretting Corrosion. R. B. Waterhouse. *Institution of Mechanical Engineers, Proceedings*, v. 169, no. 59, 1955, p. 1157-1172.

Characteristics; effect of various factors on amount of damage; possible mechanisms; preventive measures.

4193 Zinc Anodes for Use in Sea Water. J. T. Crennell and W. C. G. Wheeler. *Journal of Applied Chemistry*, v. 6, Oct. 1956, p. 415-421.

Small additions of Al to Zn containing 200 p.p.m. of Fe produce permanently active anodes. Additions refine the grain size and give a smooth corrosion pattern.

4194* (French.) Selective Oxidation of Iron Chromium Alloys in the Vicinity of the Dissociation Equilibrium of Cr_2O_3. **Oxydation selective des alliages fer-chrome au voisinage de l'équilibre de dissociation de Cr_2O_3.** J. Moreau and J. Bénard. *Journal de Chimie Physique*, v. 53, no. 10, Oct. 1956, p. 787-797.

Thermodynamic study of selective oxidation and preparation and treatment of various high purity Fe-Cr alloys. Examination of oxide formation and of the superficial structure of the metal; description of the three fields obtained.

4195* (French.) Formation of Epitaxic Layers of Oxide on a Uranium With Interference Shades by Atmospheric and Anodic Oxidation. **Formation de couches épitaxiques d'oxyde a teintes d'interference sur l'uranium a par oxydation atmosphérique et oxydation anodique.** A. Robillard and P. Lacombe. *Journal de Chimie Physique*, v. 53, no. 10, Oct. 1956, p. 798-802.

Comparative study of non-epitaxic oxidation on an electrolytically polished surface of U and of epitaxic oxidation on an etched U surface. There in no formation of a thin and amorphous film on the etched surface but there is in the other case.

4196* (French.) Dry Oxidation of Copper Manganese Alloys. **Etude de l'oxydation seche des alliages cuivre-manganese.** F. Bouillon and M. Jardinier. *Journal de Chimie Physique*, v. 53, no. 10, Oct. 1956, p. 817-822.

Formation of oxides at various temperatures. A mechanism is postulated to explain the slowing down of oxidation when Mn enters the Cu lattice between 110 and 320 C.

4197* (French.) Results of Research on the Kinetics of Oxidation of Molybdenum and Tungsten and on the Nature of the Oxides Produced. **Résultat de recherches sur la cinétique de l'oxydation du molybdène et du tungstène et sur la nature des oxydes qui apparaissent.** K. M. Gorbounova and V. A. Arslambékov. *Journal de Chimie Physique*, v. 53, no. 10, Oct. 1956, p. 871-883.

Research on oxidation at ordinary and high temperatures conducted by manometric and gravimetric methods.

4198 The Passivation of Iron by Osmium (VIII) Oxide and the Origin of the Flade Potential. G. H. Cartledge. *Journal of Physical Chemistry*, v. 60, Nov. 1956, p. 1571-1575.

The oxide is capable of inducing passivity which is very stable at room temperature and persists even up to 95 C so long as sufficient Os remains in solution. Potential is sensitive to the presence of sulfate and chloride ions of sufficient concentration.

4199 The Failure of a Welded Drying Drum by Caustic Embrittlement. George Sines and E. C. McLean. *Mechanical Engineering*, v. 78, Dec. 1956, p. 1105-1109.

An unusual failure caused by a design flaw and caustic embrittlement.

4200 Stress-Corrosion of an Aluminium Alloy. A. J. Martin. *Metal Industry*, v. 89, Dec. 21, 1956, p. 511-515.

Effect of heat-treatment on the susceptibility to corrosion and stress-corrosion of an Al-Zn-Mg alloy in sheet form. (To be concluded.)

4201* (German.) Corrosion Behavior of Flame Sprayed Zinc Layers. **Über das Korrosionsverhalten flammgespritzter Zinkschichten.** E. Gebhardt and H. D. Seghezzi. *Metalloberfläche*, v. 10, no. 12, Dec. 1956, p. 369-376.

Behavior of Zn layers 0.3 mm. thick when submitted to endurance dipping tests in water, sulphite solution, artificial sea water, gypsum water, various atmospheres, and a short steam test.

4202 Corrosion of Dissimilar Metals. Ulick R. Evans and Vera E. Rance. *Product Engineering*, v. 27, Dec. 1956, p. 187-190.

Relative corrosion of dissimilar metals in contact; effect of electrolyte, metallic coatings, and other causes on degree of attack; preventive methods and their efficiency.

4203* (German.) Corrosion of Weld Joints. **Korrosionsfälle an Schweissverbindungen.** H. Zitter. *Schweisstechnik*, v. 10, no. 9, Sept. 1956, p. 113-117.

Examples of corrosion of various types of steel in the chemical industry. Experimental data. Methods of minimizing corrosion.

4204* (German.) Observations on the Process of Intergranular Stress Crack Corrosion of Soft Plain Carbon Steels. **Beobachtungen zum Ablauf der interkristallinen Spannungsrisskorrosion weicher unlegierter Stähle.** Wilhelm Rädeker and Hubert Gräfen. *Stahl und Eisen*, v. 76, no. 24, Nov. 29, 1956, p. 1616-1628.

Ratio between stress and life as dependent on the yield point of the steel. Effects of chemical and metallurgical factors.

4205* (Russian.) Effect of Steam Concentration on Chlorine Corrosion of Metals. **Vliianie konsentratsii vodianogo para na korroziiu metallov khlorom.** Kh. L. Tseitlin and V. A. Strunkin. *Zhurnal Prikladnoi Khimii*, v. 29, no. 11, Nov. 1956, p. 1664-1673.

The influence of steam concentration on the corrosion of Al Ta, Fe, and other metals was determined in relation to temperature and moisture and compared with the action of dry Cl. Lead, Cu, and N are not corroded, but are chlorinated under certain conditions.

See also: **4292** (internal oxidation of Ag alloys).

METALS—EXTRACTION AND REFINING

4206 Separation of Niobium and Tantalum. A Literature Survey. Ernest L. Koerner and Morton Smutz. *Ames Laboratory (U. S. Atomic Energy Commission)*, ISC-793, Aug. 1956, 14 p. (UF767 Un3.1is Contin.)

A review with 42 references.

4207 Present Status and Development of Electrode Controls for Steel-Making Arc Furnaces. I-II. A. Driller. *Henry Brutcher Translation Nos.* 3665 and 3666, 11 and 21 p. (From *Stahl und Eisen*, v. 74, no. 2, 1954, p. 82-94.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 6771, v. 3, May 1954.

4208 Vacuum Treatment of Molten Steel. A. M. Samarin, L. M. Novik, N. I. Goncharenko, and A. F. Tregubenko. *Henry Brutcher Translation No.* 3816, 12 p. (From *Stal'*, v. 16, no. 8, 1956, p. 700-707.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 16265, v. 5, Dec. 1956.

4209 Oxidation of Liquid Steel During and After Tapping From an Open-Hearth Furnace. N. S. Mikhailets. *Henry Brutcher Translation No.* 3822, 9 p. (From *Stal*, v. 16, no. 3, 1956, p. 214-216.) Henry Brutcher, Altadena, Calif.

Magnitude of loss of deoxidizing agents and alloying elements outside the open-hearth furnace and detection of the point at which most loss occurs.

4210 Piercing Open-Hearth Tap Holes With Hollow Charges. N. S. Shchirenko, L. V. Ostapenko, and G. N. Rekhlis. *Henry Brutcher Translation No.* 3834, 7 p. (From *Metallurg*, v. 1, no. 7, 1956, p. 31-34.) Henry Brutcher, Altadena, Calif.

Advantages of proposed tapping practice include clean, straight hole through which the metal stream flows out evenly; no splashing out of metal; no damage to hole wall or furnace backwall or hearth; and perfect safety in application.

4211 Development of Vertical Continuous Casting of Steel. K. G. Speith and A. Bungeroth. *Henry Brutcher Translation No.* 3835, 22 p. (From *Stahl und Eisen*, v. 76, no. 8, 1956, p. 437-442.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 9596, v. 5, Aug. 1956.

4212 Electric Furnace Steel Conference. Proceedings. v. XIII. 239 p. 1956. American Institute of Mining and Metallurgical Engineers, New York. (TN706 EL25p Vis.)

Includes papers dealing with electrodes, degasification, cleanliness, furnace practice, and melting of stainless steel.

4213 Floating Zone Purification of Zirconium. G. D. Kneip, Jr. and J. O. Betterton, Jr. *Electrochemical Society, Journal*, v. 103, Dec. 1956, p. 684-689.

The Fe and Ni contents of iodide Zr are reduced to less than 2 p.p.m. The α/β transformation takes place over a temperature interval of 865 to 873 C in the purified material.

4214 Development of Continuous Casting at Atlas Steels, Ltd. William W. Jacobs. *Iron and Steel Engineer*, v. 33, Dec. 1956, p. 92-97.

Improvements include automatic controls, change in mold size, increased knowledge of solidification, and a method of adding Al in the mold.

4215 The Production of Open-Hearth Steel, With Particular Reference to Roof Life at the Vaal Works of the Union Steel Corporation (of South Africa) Limited. C. D. H. Walker, H. R. Curnick, and N. E. Dobbins. *Iron and Steel Institute, Journal*, v. 184, Dec. 1956, p. 410-413.

Origin of open-hearth steelmaking in the Transvaal. Open-hearth furnace performance. An unusually long roof life is attributed to furnace instrumentation.

4216* (Russian.) Complex Reduction of Polymetallic Iron and Nickel Ores as a Basis for New Methods in Their Chemical Treatment. **Kompleksnoe vosstanovlenie polimetallicheskikh zheleznykh i nikelevykh rud kak osnova novykh metodov ikh khimicheskoi pererabotki.** G. G. Urazov and D. P. Bogatskii. *Izvestiia Akademii Nauk SSSR, Otdelenie Khimicheskikh Nauk*, no. 10, Oct. 1956, p. 1159-1167.

An experimental and theoretical study of several processes of complex reduction of these ores by chemical treatment. The most effective conditions and apparatus are described.

4217* (Hungarian.) Sublimation Examination of Cryolites. **Kriolitok szublimációs vizsgálata.** Vjekoszláv Sejteri and Károly Abaffy. *Kohászati Lapok*, v. 11, no. 9, Sept. 1956, p. 413-417.

Determination of sublimation losses at temperatures below 850 C.

4218 Arc and Vacuum Melting of Titanium. D. E. Cooper and S. A. Herres. *Metal Industry*, v. 89, Dec. 7, 1956, p. 471-474.

The development of consumable electrode vacuum melting furnaces; characteristics of the arc. (To be continued.)

4219* (Russian.) Intensification of Flames in the Open Hearth Furnace With Oxygen. **Primenenie kisloroda dlia intensifikatsii fakela martenovskoi pechi.** K. M. Trubetskov. *Metallurg*, no. 11, Nov. 1956, p. 16-20.

Method of introduction of O and experimental results.

4220* (French.) Centenary of the Open-Hearth Furnace and Siemens-Martin Steel. **Le centenaire de four et de l'acier Siemens-Martin.** J. E. Lafon. *Métallurgie et la Construction Mécanique*, v. 88, no. 11, Nov. 1956, p. 939 + 9 pages.

A historical review of progress in the first 100 yrs. of using the Bessemer converter.

4221 A Continuous Electrolytic Process for the Production of Beryllium Metal. M. C. Kells, R. B. Holden, and C. Whitman. *Sylvania Electric Products, Inc. (U. S. Atomic Energy Commission)*, SEP-207, Apr. 1956, 43 p. (UF767 Un3.1se Contin.)

Demonstrates the continuous production of Be metal by low-temperature fused salt electrolysis using a continuously circulating Hg cathode.

4222 Producing Magnesium by Silicothermic Reduction. F. E. Block and T. T. Campbell. *U. S. Bureau of Mines, Report of Investigations* 5275, Nov. 1956, 29 p. (TN21 Un3r)

The reaction between calcined dolomite and ferrosilicon can be made to proceed at atmospheric pressure at a commercially feasible rate by operating at temperatures in the range of 1,750 to 1,800 C.

4223* (Russian.) Metallo-Thermic Method in Chemistry and Metallurgy. **Metallotermicheskie metody v khimii i metallurgii.** G. V. Samsonov and Iu. D. Chistiakov. *Uspekhi Khimii*, v. 25, no. 10, Oct. 1956, p. 1223-1248.

Physical-chemical fundamentals. Thermal characteristics of oxides used in the process. Reduction by means of Al and reducing gases. Metals as fuels.

4224* (German.) Effect of Zinc Oxide and Zinc Sulfide in Liquid Slags. **Über den Einfluss von Zinkoxyd und Zinksulfid in flüssigen Schlacken.** Friedrich Johannsen and Klaus Holler. *Zeitschrift für Erzbergbau und Metallhüttenwesen*, v. 9, no. 11, Nov. 1956, p. 511-522.

Viscosity measurements on ZnO, ZnS, and ZnO-free slags. Reactions of ZnS with ferrosilicon.

See also: **3928** (continuous casting of steel).

METALS—FINISHING, POLISHING, AND CLEANING

4225 Shotblasting of Cast Iron for Vitreous Enamelling. T. O. G. Wilkes. *Foundry Trade Journal*, v. 101, Dec. 20, 1956, p. 739-741.

Advantages of metallic grit; manufacture of metallic abrasive; castings for vitreous enameling; modern blast-cleaning machines; grit sizes and blast pressure.

4226 Self-Controlling Etch for Silver. Philip F. Kurz. *Journal of Chemical Education*, v. 33, Dec. 1956, p. 625-626.

Describes a self-controlling etching process which has been found useful for cleaning and preparing Ag surfaces for further chemical treatment. The self-controlling feature of the process is based on the release of NO_2 by heating solutions containing HNO_3 and $NaNO_2$.

4227* (Hungarian.) Chemical Polishing of Aluminum. **Az alumínium kémiai fényesítése.** Endréné Lichtenberger. *Kohászati Lapok*, v. 11, no. 9, Sept. 1956, p. 417-423.

Summary of the theory of chemical polishing. Types of Al used. Technical data on the bath and equipment. Anodic oxidation of polished surfaces.

4228 Buffs for All Purposes. Edwin F. Doyle. *Metal Finishing*, v. 54, Dec. 1956, p. 56-61, 70.

Brief description of various types of buffs that are widely used. Outstanding qualities and the types of work each is best suited for.

4229 Barrel Finishing Equipment. J. B. Mohler. *Metal Finishing*, v. 54, Dec. 1956, p. 65-70.

Description and operation.

4230 Mechanical Finishing of Precision Parts. L. H. Hopewell. *Plating*, v. 44, Jan. 1957, p. 36-39.

Development of a high-speed shaker unit for deburring small parts.

4231 Preparation for Electroplating With Coated Abrasives. Warren K. Seward. *Plating*, v. 44, Jan. 1957, p. 43-46.

Role of contact wheel; belt speed; selection, handling, and storage of abrasives; lubricants; some operating techniques.

See also: **4262** (surface finish of steel parts).

METALS—FOUNDRY PRACTICE

4232* Casting High Duty Aluminium Alloys. Kenneth A. Hill. *Australasian Engineer*, v. 49, Oct. 1956, p. 59-63.

Difficulties encountered; causes of gas porosity; pattern design.

4233 Control of Shrinkage Defects in Cast Iron. II. John Allan. *Canadian Metals*, v. 19, Dec. 1956, p. 36, 38, 40.

Influence of permeability, moisture content, poorly fitting jackets, and weights moved too soon. Shrinkage free castings can best be produced with combination of good casting design, scientific gating practice, proper selection of alloy and close attention to detail on a day to day basis.

4234 The Diecasting Process. H. K. Barton. 224 p. Odhams Press Ltd., London. (TS239 B28d)

Represents a complete modern treatment of the subject for the use of all engaged in making, buying, or using diecastings.

4235 European Foundries and Productivity. Some Recent Experiments and Achievements. 268 p. 1953. Organisation for European Economic Co-operation, Paris. (TS229.5.Al Or3e)

Attitude of the various national foundry industries towards productivity. Action taken in each country to put the lessons of American productivity into practice. Problems of human relations. Some specific instances of better productivity.

4236* (Italian.) Continuous Production of Castings. **La colata continua della ghisa.** A. Wittmoser. *Fonderia*, v. 5, no. 11, Nov. 1956, p. 545-551.

A study of continuous casting in uncoated metallic chill molds; history of the process in Germany; various applications.

4237* (Italian.) Molding Sand for Thin Castings. **Sabbia per la formatura di getti sottili.** *Fonderia*, v. 5, no. 11, Nov. 1956, p. 552-554.

Grain of an average size, 100-140 AFA, should be used with a clay binder.

4238* (Italian.) Possibilities in Precision Casting, Its Metallurgical and Technological Advantages. **Possibilità della fonderia di precisione.** Y. Dechamps. *Fonderia*, v. 5, no. 11, Nov. 1956, p. 555-569.

The use of wax in preparing economical and fine investment patterns for precision casting. Comparison of the method with other processes and limitations. Suggestions concerning plant layout and choice of alloys.

4239* (Italian.) A New Arrangement of Continuous Casting in a Malleable Cast Iron Foundry. **Una nuova linea di formatura a catena continua in una fonderia di ghisa malleabile.** Luciano Oltrasi. *Fonderia*, v. 5, no. 11, Nov. 1956, p. 575-579.

After classifying the various materials and listing the operations usual in the production of malleable castings, a new arrangement and its operation is described which resulted in more output as well as better working conditions for the workers.

4240 Green Sand Molding of Large Steel Castings. Charles W. Briggs. *Foundry*, v. 85, Jan. 1957, p. 86-93.

Recent developments and modern practices. Properties of various sands.

4241 Brass Foundry Molding Practice. Harry St. John. *Foundry*, v. 85, Jan. 1957, p. 100-103.

Molding practice; its equipment, mechanics, and accessories.

4242 Things to Watch in Producing Sound Investment Castings. C. W. Schwartz. *Foundry*, v. 85, Jan. 1957, p. 110-115.

Defects normally found by visual inspection. Some recommended remedies.

4243 Development of Hot-Blast Cupola Melting Technique in Europe. E. L. W. Löbbecke. *Foundry Trade Journal*, v. 101, Dec. 6, 1956, p. 659-666; Dec. 13, 1956, p. 697-701.

Operating experience in a foundry producing automobile castings. Use of poor-quality coke and cooled melting zone without lining. Problems of S content and dust control.

4244 Some Aspects of Shell-Moulding Theory. A. Braybrook and B. H. C. Waters. *Foundry Trade Journal*, v. 101, Dec. 20, 1956, p. 721-729; Dec. 27, 1956, p. 753-762.

Shell strength, hardness, and permeability; effect of clay; precoated sand; gas content; surface finish of castings; shell closing; running and feeding; metal structure; pattern plates.

4245* (German.) Hydrodynamic Tests of Mold Filling Capacity. **Hydrodynamische Untersuchungen des Formfüllungsvermögens.** Erich Scheil and Dieter Pohl. *Giesserei*, v. 43, no. 25, Dec. 6, 1956, p. 805-812.

Describes apparatus for hydrodynamic measurements on cast iron. Principles underlying the measurements. The flow of liquid metal is studied in relation to the general laws of hydrodynamics.

4246* (German.) Synthetic Resin-Core Binder. **Kunstharz-Kernbinder.** L. Chroszcz. *Giessereitechnik*, v. 2, no. 4, Apr. 1956, p. 90-92.

Manufacture of core binder; drying and viscosity-temperature relationships.

4247* (German.) Symposium on Technology of Carbon Dioxide Mold Hardening. **Die Festigkeit wasserglasgebundener Quarzsande im Bereich wechselnder Zusätze und Wasserglaskonzentrationen.** J. Czikel and R. Wasner. *Giessereitechnik*, v. 2, no. 6, June 1956, p. 121-140.

Consists of seven papers on as many aspects of CO_2 hardening of silicate-bonded mold sands.

4248* (German.) Application of Vacuum in Sand- and Iron-Chill-Casting to Decrease Waste. **Anwendung des Vakuums in Sand- und Kokillenguss zur Herabsetzung des Ausschussanfalls.** Lothar Pilz. *Giessereitechnik*, v. 2, no. 9, Sept. 1956, p. 202-206.

Use of vacuum in thin-section casting of light metals. Description of a transportable vacuum device.

4249* (German.) Symposium on Chill Gray Iron and Light Metal Casting. **Entwicklungsstand und Perspektiven des Kokillengraugusses.** Fritz Naumann. *Giessereitechnik*, v. 2, no. 10, Oct. 1956, p. 217-242.

Five papers on chill casting techniques.

4250* (Hungarian.) Increasing the Efficiency of Melting Furnaces for Non-Ferrous Metals. **Fémolvasztó kemencék hőkihasználásának növelése.** Gyula Emőd. *Öntöde*, v. 7, no. 9, Sept. 1956, p. 210-213.

Characterization of modern furnace types and methods for improving the performance of older furnaces.

4251* (Polish.) Die Casting Plumbing Pipes. **Odlewanie rur kanalizacyjnych w kokilach.** Leon Meyro. *Przeglad Odlewnictwa*, v. 6, no. 11, Nov. 1956, p. 346-349.

Construction and use of dies for casting pipe 100 mm. in diameter, 2,000 mm. long, with 4 mm. thick walls.

4252* (French.) Die Casting of Automobile Engine Cylinder Blocks. **La coulée sous pression des blocs-cylindres de moteurs d'automobiles.** V. Boghossian. *Revue de l'Aluminium*, v. 33, no. 236, Oct. 1956, p. 931-937.

Describes the most powerful die casting machine in the world capable of producing parts weighing 77 lbs. in Al or 198 lbs. in Zn.

See also: **4139** (design of castings); **4315** (high vacuum melted Ti).

METALS—HEAT TREATMENT

4253* (Russian.) Thermo-Mechanical Working of Contact Welded Joints. **Termomekhanicheskaia obrabotka stykov, svarivaemykh kontaktnym sposobom.** A. V. Obukhov and V. B. Shliapin. *Avtomaticheskaia Svarka*, v. 9, no. 5, Sept.-Oct. 1956, p. 31-36.

Description of a process for hardening welded components which improves strength and plasticity of the joint and area around the joint to a degree which usual normalizing cannot achieve.

4254 Surface Hardening of Large Crankshaft Journals by Induction Heating at Low Specific Power. G. M. Tel'nov and S. N. Sizov. *Henry Brutcher Translation No.* 3592, 9 p. (From *Vestnik Mashinostroeniya*, v. 34, no. 12, 1954, p. 66-68.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 6975, v. 4, May 1955.

4255 High-Temperature Gas Carburizing of Steel. G. M. Shuval, I. S. Lupakov, and I. A. Feldman. *Henry Brutcher Translation No.* 3806. 8 p. (From *Metallovedenie i Obrabotka*

Metallov, v. 2, no. 6, 1956, p. 49-52.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 14756, v. 5, Nov. 1956.

4256 Dimensional Changes of Steel on Case Carburizing. B. Finnern. *Henry Brutcher Translation No.* 3817, 16 p. (From *Archiv Eisenhüttenwesen*, v. 25, nos. 7-8, 1954, p. 345-350.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 17769, v. 3, Dec. 1954.

4257* Complete Mechanization of Heat Treating. A Growing Trend. O. E. Cullen. *Flow*, v. 12, Jan. 1957, p. 55-58.

Examples of recent installations.

4258 Modernization Can Cut Costs in Annealing Malleable Iron. Carl L. Ipsen. *Foundry*, v. 85, Jan. 1957, p. 104-109.

Analysis of benefits available to producers of malleable iron through use of modern heat treating equipment.

4259* (German.) The Heat Treatment of Steel Castings. **Zur Wärmebehandlung von Stahlguss.** Walther Hiller. *Giesserei*, v. 43, no. 24, Nov. 22, 1956, p. 777-784.

Important factors in successful casting of steel; effects of alloying elements; annealing, normalizing, and tempering procedures; temperatures for heat-treating the various types of German steels.

4260 Gas-Fired Batch Furnace With Controlled Atmosphere Meets Variety of Heat Treat Problems. James B. Smith. *Industrial Heating*, v. 23, Dec. 1956, p. 2713 + 4 p.

How one heat treater meets his customers' varied demands with versatile equipment.

4261 Tempering and Nitriding of 3% Chromium Steels. C. C. Hodgson and H. G. Baron. *Iron & Steel*, v. 29, Dec. 1956, p. 623-628.

4262* (German.) Induction Heating Prior to Hot-Forming as a Means of Improving the Surface Finish of Steel Parts. **Induktionserwärmung zum nachfolgenden Warmverformen als Mittel zur Verbesserung der Oberflächenbeschaffenheit von Stahlteilen.** G. W. Seulen. *Metalloberfläche*, v. 10, no. 12, Dec. 1956, p. 353-355.

Effect of inductive heating on the surface finish of steel parts in automobile and machine construction. Apparatus is described with various applications to die forging and sleeve and tube manufacture.

4263* (French.) Problems of Regulation of Induction Surface Hardening. **Problèmes de régulation dans la trempe superficielle par induction.** C. Di Pieri. *Métallurgie et la Construction Mécanique*, v. 88, no. 11, Nov. 1956, p. 931-937.

A study of the operation of H.F. generators with electronic valves for induction hardening. Grid current adjustment and power regulation.

4264 The Safe Operation of Atmosphere Furnaces. J. Huebler. *Metal Progress*, v. 70, Dec. 1956, p. 78-83.

Some atmospheres used in industrial furnaces can explode if carelessly managed. The best preventive is adequate training of operating personnel.

4265 Heat Treating Instructions for Toolsteel. William P. Loehrer. *Metal Progress*, v. 70, Dec. 1956, p. 115.

An instruction sheet accompanying each shipment of toolsteel has eliminated heat treating difficulties for small-volume users.

4266 Instrumentation in the Heat-Treatment of Steel. I. The Nature of the Problem. W. F. Coxon. *Metal Treatment and Drop Forging*, v. 23, Dec. 1956, p. 499-502.

Furnace requirements; heat-treatment in controlled atmospheres; endothermic atmospheres; typical heat-treatment defects.

4267 Current Heat-Treatment Practice. R. J. Brown. *Metal Treatment and Drop Forging*, v. 23, Dec. 1956, p. 503-511.

A review of the latest types of furnace with examples of various types of heat treatment.

4268 Production Annealing of Zircaloy-2. J. G. Goodwin and K. M. Goldman. *Westinghouse Electric Corporation, Atomic Power Division (U. S. Atomic Energy Commission)*, WAPD-120, May 1955, 32 p. (UF767 Un3.1wa Contin.)

Curves which relate time, temperature, and percent cold reduction with hardness for Zircaloy-2 annealed in air.

4269* (German.) The Crucible Problem in Long Duration Annealing of Germanium. **Über das Tiegelproblem bei Langzeitglühung von Germanium.** Wolfram Bösenberg. *Zeitschrift für Angewandte Physik*, v. 8, no. 11, Nov. 1956, p. 551-552.

A study of quartz glass and graphite as materials for the container used. Such materials must be spectrally pure and should not react nor form alloys. In pure Ge the impurity concentration must be lower than 2×10^{-5} at. %.

See also: **4276** (heat treatment of alloy steel); **4371** (tempering of carbon steels); **4394** (carbonitriding of Fe-powder products); **4766** (dew point-temperature diagram for H atm.).

METALS—MECHANICAL AND PHYSICAL PROPERTIES

4270* (Spanish.) High Strength Steels. **Aceros de muy alta resistencia.** J. A. Garcia Poggio. *Acero y Energia*, v. 13, no. 77, Sept.-Oct. 1956, p. 50-52, 55-60.

Causes and remedies for brittleness of Spanish and other steels of high Si content.

4271 Internal Friction and Fatigue in Metals at Large Strain Amplitudes. W. P. Mason. *Acoustical Society of America, Journal*, v. 28, Nov. 1956, p. 1207-1218.

Experimental determinations using a barium titanate transducer coupled to an exponential horn.

4272* (English.) **Internal Friction and Diffusion in 31% Alpha Brass.** J. Hino, C. Tomizuka, and C. Wert. *Acta Metallurgica*, v. 5, no. 1, Jan. 1957, p. 41-49.

4273* (Russian.) Wearability of Steel and Residual Stresses in Surface Layers. **Iznosostoikost' stali i ostatochnye napriazheniia v poverkhnostnykh sloiakh.** D. A. Draigor and V. A. Shevchuk. *Akademiia Nauk Ukrains'koi RSR, Dopovidi*, no. 5, 1956, p. 430-433.

Distribution of stresses; tension effects on wearability; optimal tensile strength.

4274* (German.) Static and Fatigue Properties of High Strength Aluminum Alloys. **Statische und dynamische Festigkeitseigenschaften hochfester Aluminiumlegierungen.** P. Brenner. *Aluminium*, v. 32, no. 12, Dec. 1956, p. 756-768.

Endurance limits for smooth and notched specimens.

4275* (German.) Iron-Chromium Alloy Damping Test. **Dämpfungsuntersuchungen an Eisen-Chrom-Legierungen.** Karl Bungardt and Hans Preisendanz. *Archiv für das Eisenhüttenwesen*, v. 27, no. 11, Nov. 1956, p. 715-724.

Investigation of steel with up to 45% Cr in a vacuum. Damping values were highest at 220, 600 and 720 C. Effect of cold deformation.

4276* Isothermal Heat-Treatment of Agricultural Tynes. L. S. Heard. *Australasian Engineer*, v. 49, Oct. 1956, p. 63-65.

Investigation of variable hardness and cracking in a hardened and tempered Cr-Zr steel.

4277 Effect of Temperature on the Softening of Alloys. I. I. Kornilov. *Henry Brutcher Translation No.* 3773, 5 p. (From *Doklady Akademii Nauk SSSR*, v. 106, no. 5, 1956, p. 845-847.) Henry Brutcher, Altadena, Calif.

Correlation of temperatures at which the 100-hr. stress-rupture strength is 21,000 psi. as an arbitrary index of the softening temperature for several Ni alloys.

4278 On Some Electrical and Magnetic Properties of Metallic Solid Solutions. J. Friedel. *Canadian Journal of Physics*, v. 34, Suppl. no. 12A, Dec. 1956, p. 1190-1211.

Resistivity, thermoelectric power, and magnetic susceptibility of metallic solid solutions at room temperature; relation to electronic structure.

4279 Electrical Resistance Due to Lattice Imperfections in Metals. P. G. Klemens. *Canadian Journal of Physics*, v. 34, Suppl. no. 12A, Dec. 1956, p. 1212-1218.

4280 On the Electrical Resistivity of Stacking-Faults in Monovalent Metals. Alfred Seeger. *Canadian Journal of Physics*, v. 34, Suppl. no. 12A, Dec. 1956, p. 1219-1235.

Experimental and theoretical analysis.

4281 Remarks on the Anomalous Behavior of Alloys Containing Traces of Manganese or Similar Elements. C. J. Gorter, G. J. van den Berg, and J. de Nobel. *Canadian Journal of Physics*, v. 34, Suppl. no. 12A, Dec. 1956, p. 1281-1284.

While rapid decrease of electric resistance sometimes occurring at very low temperatures apparently must be attributed to some kind of antiferromagnetic alignment, the resistance minimum, as well as anomalies in thermoelectricity and the Hall effect, might be due to gaps at crystalline boundaries.

4282 Magnetization and Magnetoresistance of Some Dilute Alloys of Mn in Cu. R. W. Schmitt and I. S. Jacobs. *Canadian Journal of Physics*, v. 34, Suppl. no. 12A, Dec. 1956, p. 1285-1289.

4283 On the Resistivity Anomalies in Some Diluted Alloys. J. Korringa. *Canadian Journal of Physics*, v. 34, Suppl. no. 12A, Dec. 1956, p. 1290-1291.

Some observations on scattering mechanisms possibly accounting for known properties of alloys of Mn in Cu.

4284 Electrical and Thermal Conductivity of Metals. K. Mendelssohn. *Canadian Journal of Physics*, v. 34, Suppl. no. 12A, Dec. 1956, p. 1315-1327.

A survey of recent unpublished work illustrating some of the present trends and in particular the use of the phenomenon of superconductivity as a useful tool in the study of metals.

4285 Conductivity of Metals at Low Temperatures. G. K. White. *Canadian Journal of Physics*, v. 34, Suppl. no. 12A, Dec. 1956, p. 1328-1333.

Some observations with non-superconducting metals. Temperature dependence of the resistivity due to scattering of electrons by thermal vibrations in the case of some representative alkali and transition metals.

4286 Phenomenological Aspects of the Resistivity of Pure Metals. G. Borelius. *Canadian Journal of Physics*, v. 34, Suppl. no. 12A, Dec. 1956, p. 1336-1341.

4287 Hydrogen Embrittlement of Cold-Worked Metals. R. L. Mills and F. J. Edeskuty. *Chemical Engineering Progress*, v. 52, Nov. 1956, p. 477-480.

Evaluation of specimens subjected to high-pressure H at room temperature.

4288* (French.) Electrical Resistance of Copper-Aluminum Alloys. **Sur la résistance électrique des alliages cuivre-aluminium.** Genevieve Darmois and Sylvain Janssen. *Comptes Rendus*, v. 243, no. 2, Nov. 12, 1956, p. 1496-1499.

For Cu_2Al the specific electric resistance was found to be 28 micro-ohms. The very low temperature coefficient is explained and alloys varying in Cu content studied to corroborate the explanation.

4289* (French.) Deformations and Cracks. **Déformations et criques.** Joseph Léonard. *Fonderie*, no. 129, Oct. 1956, p. 389-394.

Deformation is a motion distributed in the whole metallic part with stresses and sometimes cracks and chinks, although these may be independently created by localized accidents. The last cause of deformation is a determining but not always preponderant factor.

4290 Effect of Cerium on Mechanical Properties of a Cast Titanium Alloy. H. W. Antes and R. D. Edelman. *Foundry*, v. 85, Jan. 1957, p. 116-119.

Cerium additions reduced the cast grain size of the alloy, with an accompanying loss in ductility and strength due to the presence of a Ce rich phase at the grain boundaries.

4291* (German.) Surface Tension of Cast Iron. **Über die Oberflächenspannung von Gusseisen.** Dieter Pohl and Erich Scheil. *Giesserei*, v. 43, no. 26, Dec. 20, 1956, p. 833-839.

Significance of surface tension; its physical-chemical relationship. Advantages and disadvantages of static and dynamic methods of measuring surface tension. Oscillating rays method and its application.

4292 The Effects of Internal Oxidation on the Tensile Properties of Some Silver Alloys at Room and Elevated Temperatures. E. Gregory and G. C. Smith. *Institute of Metals, Journal*, v. 85, Nov. 1956, p. 81-87 + 1 plate.

Study of conditions affecting the production of non-metallic phases by internal oxidation of Ag alloys containing Si or Al. A very marked inhibition of grain growth and recrystallization by the disperse phase was obtained.

4293 The Hardness of Manganese and Some Manganese-Rich Alloys. Vernon Griffiths and H. O'Neill. *Institute of Metals, Journal*, v. 85, Nov. 1956, p. 105-108 + 1 plate.

Diamond-pyramid hardness tests on electrolytic Mn and some of its dilute alloys show that α-Mn is about ten times as hard as the γ phase.

4294* On the Basic Yield Stress Curve for a Metal. A. B. Watts and Hugh Ford. *Institution of Mechanical Engineers, Proceedings*, v. 169, no. 58, 1955, p. 1141-1156.

The plane compression test, using two parallel smooth dies, is an accurate means to determine yield stress curve and has distinct advantages over other methods for large deformations.

4295 A Proposed Method for Calculating Residual Stresses in Iron Rolls. Charles F. Peck, Jr. *Iron and Steel Engineer*, v. 33, Dec. 1956, p. 121-124.

An analytical method whereby residual internal stresses in double-poured cast-iron work rolls may be calculated from measured residual surface stresses.

4296 The Craze-Cracking of Metals. L. Northcott and H. G. Baron. *Iron and Steel Institute, Journal*, v. 184, Dec. 1956, p. 385-408.

Review of previous work; development of suitable test equipment. Some experiments with heating one face of a small test-piece intermittently by H.F. induction while the main body is continuously water-cooled.

4297* (Russian.) Relationship Between Composition, Temperature, and Heat Resistance. **Sootnoshenie mezhdu sostavom, temperaturoi i zharoprochnostiu. III.** Five Component Alloys of the System: Nickel-Chromium-Tungsten- Aluminum-Titanium. **Splavy piaternoi sistemy nikel'-khrom-vol'-from-aliuminii-titan.** I. I. Kornilov and F. M. Titov. *Izvestiia Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk*, no. 10, Oct. 1956, p. 117-122.

Relationships between composition and heat resistance of a five component system are essentially similar to those of binary and ternary systems.

4298* (Russian.) Studies on the Recrystallization of Titanium and Its Alloys. **Issledovanie rekristallizatsii titana i ego splavov. III.** Effect of Annealing Temperature on the Mechanical Properties and Micro-Structure of Titanium. **Vliianie temperatury otzhiga na mekhanicheskie svoistva i mikrostrukturu titana.** E. M. Savitskii and M. A. Tylkina. *Izvestiia Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk*, no. 10, Oct. 1956, p. 125-127 + 2 plates.

Determination of heating conditions in deformation and annealing which result in optimum mechanical properties.

4299* (Russian.) Secondary-Electronic Emission of Alloys on Nickel Base. **Vtorichno-elektrannaia emissiia splavov na osnove nikelia.** B. S. Kul'varskaia. *Izvestiia Akademii Nauk SSSR, Seriia Fizicheskaia*, v. 20, no. 9, Sept. 1956, p. 1029-1037.

Physical-chemical properties of the alloy components determining the emitter stability in Ni-Be, Ni-Zr, Ni-Ti, Ni-Ba, and Ni-Mn alloys. Control of the emitter properties by the amount of absorbed O.

4300 A New Method of Analyzing Stresses and Strains in Work-Hardening Plastic Solids. William Prager. *Journal of Applied Mechanics*, v. 23, Dec. 1956, p. 493-496.

Use of a segmentwise linear yield condition and associated flow rule is illustrated by analysis of bending moments and deflections of a simply supported circular plate made of a work-hardening material and subjected to a uniformly distributed transverse load.

4301 Effect of Electron Irradiation on Young's Modulus. H. Dieckamp and A. Sosin. *Journal of Applied Physics*, v. 27, Dec. 1956, p. 1416-1418.

Young's modulus and internal friction measurements on high-purity Cu following electron bombardment. Modulus rose rapidly with electron flux reaching an early saturation followed by a slow decrease.

4302 Tensile Strength of Whiskers. S. S. Brenner. *Journal of Applied Physics*, v. 27, Dec. 1956, p. 1484-1491.

Tests on whiskers of Fe, Cu, and Ag 1.2 to 15μ in diameter. The strongest whiskers which were less than the 4μ in diameter exhibited resolved elastic shear strengths of from 2 to 6% of their shear moduli.

4303 An Automatic Electromechanical Stressing Unit for Creep and Fatigue Testing. A. J. Kennedy and R. F. Slade. *Journal of Scientific Instruments*, v. 33, Nov. 1956, p. 409-410.

Stress is imposed by means of a mechanical spring, so that inertia effects, particularly when loading is repetitive, are negligible. The same system may be used to conduct creep recovery or stress relaxation tests.

4304* Creep of Mild Steel. Toshio Nishihara, Shuji Taira, and Kichinosuke Tanaka. *Kyoto University, Engineering Research Institute Technical Reports*, v. 6, no. 6, Aug. 1956, p. 99-125.

Analysis of creep mechanism from the rheological stand-point resulted in a formula representing stress-strain-time relation, useful for interrelating creep characteristics and tension test data.

4305* Creep of Low Carbon Steel Under Interrupted Stressing. Toshio Nishihara, Shuji Taira, Kichinosuke Tanaka, and Kiyotsugu Ohji. *Kyoto University, Engineering Research Institute Technical Reports*, v. 6, no. 7, Oct. 1956, p. 127-145.

Data from constant stress tests is compared with results of creep tests under stepwise changing stress at 450 C.

4306* Fatigue Strength of Metals Under Alternating Stresses of Varying Amplitude. Toshio Nishihara and Toshiro Yamada. *Kyoto University, Memoirs of the Faculty of Engineering*, v. 18, no. 3, July 1956, p. 172-208.

Formulas for predicting fatigue life and fatigue limit. Testing machines and their use on unnotched or notched specimens of low- and high-carbon steels, and duralumin.

4307* Effect of Anodic Surface Films on the Plastic Deformation of Aluminium Crystals. Jin-ichi Takamura. *Kyoto University, Memoirs of the Faculty of Engineering*, v. 18, no. 3, July 1956, p. 255-279.

Two sections of a long single crystal of 99.99% pure Al were electropolished, one in a solution of orthophosphoric acid, and the other in Jacquet's bath of perchloric acid-acetic anhydride. The former section, composed of alternatively thin and thicker parts, had a mean thickness of over 300 A; the latter showed a relatively uniform thickness of less than 100 A. It is shown that such films cause differences in plastic behavior: thicker anodic films raise yielding stress and suppress crystal twisting and development of fine slip and kink bands. They also affect the fine structure of slip bands and give rise to abnormal slip markings. Such effects are explained on the basis of dislocations piled up beneath the surface film.

4308* (Dutch.) Practical Considerations on Brittle Fracture in Steel. **Praktische aspecten ten aanzien van het brosbreken van staal.** G. E. Tummers. *Metalen*, v. 11, no. 22, Nov. 30, 1956, p. 496-502.

Brittle fracture in steel structures, caused by tension and bending stresses, was examined in relation to its two possible types, origin, propagation, favoring elements and testing methods. The choice of material was also considered. (To be continued.)

4309 Intercrystalline Brittleness of Beta Brass. A. R. Bailey. *Metal Industry*, v. 89, Nov. 30, 1956, p. 449-452.

Evidence of grain boundary segregation in alloys containing Al.

4310* (German.) Creep and Fracture Danger in a Case of Multi-Axis Stress. **Fliessgefahr und Bruchgefahr bei mehrachsiger Beanspruchung.** K. Matthaes. *Metall*, v. 10, nos. 17-18, Sept. 1956, p. 795-800.

Theoretical discussion applied to metallic and non-metallic materials.

4311* (German.) Saturation Vapor Pressure of Metals. **Der Sättigungsdampfdruck der Metalle. II.** E. Waldschmidt. *Metall*, v. 10, nos. 23-24, Dec. 1956, p. 1126-1133.

Experimental data on 41 different metals.

4312* (German.) The Electrical Conductivity of Chemically Produced Nickel Layers. **Die elektrische Leitfähigkeit von chemisch erzeugten Nickelschichten.** A. Keil and B. Berger. *Metalloberfläche*, v. 10, no. 12, Dec. 1956, p. 356-357.

Bath types and working conditions for the production of Ni coatings. Measurements show a conductivity about 14% lower in these layers than in pure Ni.

4313 Low-Temperature Brittleness. Charles S. Barrett. *Metal Progress*, v. 70, Dec. 1956, p. 68-72.

Scientific investigations of metallurgical behavior at low temperature show the interrelation between brittle fracture of ship plate and many of the physical properties which are determined by crystalline perfection.

4314 Recent Studies on Ductile Molybdenum. Julius J. Harwood. *Metal Progress*, v. 70, Dec. 1956, p. 97-101.

Small amounts of O, as well as N and C, tend to form grain-boundary films which start and propagate cracks between very ductile crystals. A little Ti is most efficient in rendering these impurities innocuous.

4315 Properties of Titanium Melted Under High Vacuum. R. L. Folkman and M. Schussler. *Metal Progress*, v. 70, Dec. 1956, p. 111-114.

The ductility and notch toughness of Ti melted under pressures in the low μ range are appreciably better than those of Ti melted under usual pressures in the low mm. range.

4316 (English.) **Fatigue Crack Propagation in Light Alloys.** J. Schijve. *Nationaal Luchtvaartlaboratorium, Rapport* NLL-TNM 2010, July 1956, 27 p. + 16 plates. (TL526.N3 N38.5r Contin.)

Theoretical considerations. The consequences of a fatigue crack in an aircraft structure.

4317 Further Studies on Stainless-Steel Hot Cracking. P. P. Puzak and H. Rischall. *Naval Research Laboratory, Report* 4861, Nov. 1956, 10 p. (T21 Un3.5n Contin.)

Test data provide evidence that grain-boundary liquation is responsible for base-metal hot cracking of stainless steels.

4318 The Nominal Cleavage Strength of Steel and Its Importance for Welded Structures. T. M. Norén. *North East Coast Institution of Engineers & Shipbuilders, Transactions*, v. 73, Dec. 1956, p. 87-112.

Testing principles, methods, and interpretation.

4319 Reflectance of Evaporated Aluminum in the Vacuum Ultra-Violet. G. Hass, W. R. Hunter, and R. Tousey. *Optical Society of America, Journal*, v. 46, Dec. 1956, p. 1009-1012.

The effect of speed of evaporation, pressure, thickness, and age on the reflectance of evaporated Al films was investigated from 900 to 2200 A. High speed of evaporation is the most important factor.

4320 Comparison of Calculated and Experimental Values for the Optical Reflectivity of the Liquid Alloys Hg-In, Hg-Tl, Ga-In at 25°C. L. G. Schulz. *Optical Society of America, Journal*, v. 47, Jan. 1957, p. 70-72.

4321 The Heat Capacities of Chromium and Nickel. J. A. Rayne and W. R. G. Kemp. *Philosophical Magazine*, v. 1, ser. 8, no. 10, Oct. 1956, p. 918-925.

4322 The Cold Work Introduced During the Fatigue of Copper. R. D. McCammon and H. M. Rosenberg. *Philosophical Magazine*, v. 1, ser. 8, no. 10, Oct. 1956, p. 964-966.

Evidence supporting view that energy stored in a fatigued metal is released at a different temperature and at a different rate from that stored in a metal strained in tension.

4323 Calculation of the Elastic Shear Constants of Magnesium and Magnesium Alloys. John R. Reitz and Charles S. Smith. *Physical Review*, v. 104, ser. 2, Dec. 1, 1956, p. 1253-1259.

Leigh's calculation of the elastic shear constants of Al are extended to include crystals of lower symmetry, and the results are used to interpret the constants of pure Mg and dilute Mg alloys.

4324 Magnetization Reversal in Thin Films. Donald O. Smith. *Physical Review*, v. 104, ser. 2, Dec. 1, 1956, p. 1280-1281.

The magnetization reversal of thin films (1000 A thick) of 80-20 Permalloy has been studied in a strip transmission line. These films are evaporated onto a heated glass substrate in the presence of an orienting field. Magnetization reversal along the axis of initial orientation takes place in times less than 20mμ. sec. in any reversing field large enough to overcome the orienting energy.

4325* (English.) **The Measurement of Magnetostriction by Means of Strain Gauge.** Hideo Takaki and Toshiro Tsuji. *Physical Society of Japan, Journal*, v. 11, no. 11, Nov. 1956, p. 1153-1156.

Measurements on long rod single crystals of 3.2% Si-steel were compared with results obtained on the same samples by using a mechano-optical lever.

4326 The Magnetic Susceptibilities of Palladium-Uranium Alloys. L. F. Bates and S. J. Leach. *Physical Society, Proceedings*, v. 69, no. 442B, Oct. 1956, p. 997-1005.

Measurements are made of the paramagnetic susceptibilities of Pd-U alloys covering the range of solid solution, of an intermetallic compound Pd_3U, and of specimens of very pure Pd and U over the temperature range 77 to 293 K.

4327 Constant Stress Creep Apparatus. Raymond C. Boettner and W. D. Robertson. *Review of Scientific Instruments*, v. 27, Dec. 1956, p. 1039-1040.

Apparatus used with specimens of large cross sections, where large applied loads are required, consists of a lever with a large built-in mechanical advantage, together with means for removal of incremental weights from the applied load.

4328 Deformation Twinning in Materials of the *A4* (Diamond) Crystal Structure. A. T. Churchman, G. A. Geach, and J. Winton. *Royal Society, Proceedings*, v. 238, ser. A, Dec. 18, 1956, p. 194-203 + 4 plates.

Deformation produced by hardness indentations in Si, Ge, InSb, GaSb, and Zn blende was studied.

4329* (Russian.) Investigation of Fatigue Strength of Joints Obtained by Electro-Slag Welding of Large Sections. **Issledovanie ustalostnoi prochnosti soedinenii vypolnennykh elektroshlakovoi svarkoi na obraztsakh bol'shogo secheniia.** I. V. Kudriavtsev and N. M. Savvina. *Svarochnoe Proizvodstvo*, no. 11, Nov. 1956, p. 1-6.

Experimental investigation of fatigue of joints after various heat treatments.

4330 Further Studies on the Effect of Microstructure on Notch Toughness and Fracture Morphology. J. C. Danko, J. H. Gross, and R. D. Stout. *Welding Journal*, v. 35, Dec. 1956, p. 604S-609S.

Influence of some types of discontinuous phases in a nominally constant ferrite matrix on the notch toughness of the aggregate.

4331 Triaxial Tension Testing and the Brittle Fracture Strength of Metals. N. Bredzs and H. Schwartzbart. *Welding Journal*, v. 35, Dec. 1956, p. 610S-615S.

A test for determining brittle fracture strength. Effect of joint thickness on the tensile strength of mild steel and drill rod brazed with Ag and Cu.

4332 Shock Testing Instrumentation. F. Card. *Westinghouse Electric Corporation, Atomic Power Division (U. S. Atomic Energy Commission)*, WAPD-TM-16, July 1956, 20 p. (UF767 Un3.1wa Contin.)

A specimen is used as a simply supported beam that is struck by a standard charpy impact machine with a greatly reduced pendulum swing, to provide a shock. The loading is sensed by a Glennite accelerometer and the strain by an SR-4 gage.

4333* (German.) Hysteresis Relaxation and Permeability of Ferro Silicon Containing Carbon. **Hysterese-Relaxation und Permeabilität von kohlenstoffhaltigem Silizium-Eisen.** Friedrich Schreiber. *Zeitschrift für Angewandte Physik*, v. 8, no. 11, Nov. 1956, p. 539-551.

Studies within a range of low field intensities.

4334* (German.) Electrode Free Measurement of Electrical Conductivity by Means of Field Rotation Method. **Elektrodenlose Messung der elektrischen Leitfähigkeit mit der Drehfeld-methode.** Albert Roll, Hans Felger, and Hasso Motz. *Zeitschrift für Metallkunde*, v. 47, no. 11, Nov. 1956, p. 707-713.

A laboratory device for measuring the electrical resistivity of metals without connections up to temperatures of 1250 C.

4335* (German.) Effect of Plastic Deformation on the Magnetic Properties of Nickel Single Crystals. **Dr Einfluss plastischer Verformung auf die magnetischen Eigenschaften von Nickel-Einkristallen. II.** Solidification Curve and Effect of Temperature on the Coercive Force. **Verfestigungskurve und Temperaturabhängigkeit der Koerzitivkraft.** Hermann Dietrich and Eckart Kneller. *Zeitschrift für Metallkunde*, v. 47, no. 11, Nov. 1956, p. 716-728.

The influence of plastic deformation on intensity and temperature-dependence of the coercivity of rod-shaped pure Ni was investigated at temperatures between 200 C and the Curie point.

4336* (German.) Viscosity and Density Measurement of Liquid Smelted Potassium Amalgam. **Viskositäts- und Dichtemessungen an schmelzflüssigen Kaliumamalgamen.** Alfred Roeder and Wilhelm Morawietz. *Zeitschrift für Metallkunde*, v. 47, no. 11, Nov. 1956, p. 734-741.

Viscosity measurements based on oscillations of fluid cylinders in the system K-Hg up to 320 C.

4337* (Russian.) Volatility of Germanium in a Gaseous Stream. **O letuchesti germaniia v toke gazov.** V. G. Tronev and M. E. Chibireva. *Zhurnal Neorganicheskoi Khimii*, v. 1, no. 10, Oct. 1956, p. 2278-2282.

Germanium powder in a N stream containing 1% O, in an A stream with 0.25% N and 0.03% O is transformed (94 to 95%) into sublimate at 800 to 850 C.

See also: **3380** (effect of coatings on creep); **4109** (surface damage to metals); **4139** (properties of cast iron); **4361** (properties of Ni-Cr alloys and Ni-Cr steels); **4374** (deformaton of Fe alloys); **4571** (acoustics and metal properties); **4758** (creep of soldered joints).

METALS—MECHANICAL WORKING

4338 Effect of Vibration Amplitude, Frequency, and Composition of the Abrasive Slurry on the Rate of Ultrasonic Machining in Ketos Tool Steel. Dieter Goetze. *Acoustical Society of America, Journal*, v. 28, Nov. 1956, p. 1033-1037.

Results of experiments on an SAE 1095 tool steel.

4339 Radioactive Wear Measurements, an Approach to Rapid Routine Testing for Tool Performance. O. Hake. *Henry Brutcher Translation No.* 3584, 8 p. (From *Industrie Anzeiger*, v. 77, no. 45, 1955, p. 627-630.) Henry Brutcher, Altadena, Calif.

A method based on γ-ray measurements of the quantity of activated tool material taken away by the chips in machining operations. Data on machining a semi-hard C steel with tools tipped with five different cemented carbide compositions and a high-speed tool steel.

4340 What Chips Really Mean to Carbide Cutters. Horace Frommelt. *Iron Age*, v. 179, Jan. 10, 1957, p. 59-62.

Chip clearance space, chip shape and size, thickness, method of milling, and vibration are important factors in detecting causes and cures for milling problems.

4341 Rolling of Thin Strip. II. M. D. Stone. *Iron and Steel Engineer*, v. 33, Dec. 1956, p. 55-76.

Development and use of nomographic chart for determining rolling pressure and power; some power phenomena associated with high pressure, thin strip rolling.

4342 Hot Extrusion of Carbon Steel Solid Sections. Joseph K. Seyler. *Iron and Steel Engineer*, v. 33, Dec. 1956, p. 89-91.

Process particularly suitable for small orders and complicated sections.

4343* (Russian.) Studying Rolling Conditions of Titanium Alloys. **Issledovanie uslovii prokatki titanovykh splavov.** V. K. Belosevich, V. F. Kalugin, N. I. Korneev, I. M. Pavlov, I. G. Skucharev, and A. E. Shelest. *Izvestiia Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk*, no. 10, Oct. 1956, p. 15-27.

Studies made on Ti-Al alloys rolled into sheets. Determination of microstructure, gas saturation, plasticity, deformation resistance in rolling, and other properties. Changes in properties as a function of rolling temperature.

4344 Cold-Forming Methods for Fabrication of Inert Rocket Components During Development. H. R. Grant. *Jet Propulsion*, v. 26, Dec. 1956, p. 1088-1090.

4345* Concentration Effects of Cutting Oil Additives in Performance Evaluation. A. Dorinson. *Lubrication Engineering*, v. 12, Nov.-Dec. 1956, p. 387-391.

Tests including turning, planing, and tapping demonstrated the concentration-dependent activity of additives in cutting oils.

4346 Production Design Techniques for Cold Roll Forming. Richard T. Angel. *Machine Design*, v. 28, Dec. 13, 1956, p. 106-112.

Advantages and limitations of process; auxiliary operations; tolerance specifications; use of new metals.

4347 Some Observations With the Electric Spark Machining Process. G. R. Wilms and J. B. Wade. *Metallurgia*, v. 54, no. 326, Dec. 1956, p. 263-273.

In a study of the spark machining of Al, Sb, Cr, and Fe evidence has been found that both deformation and cracking of the surface can occur. In practical applications, these effects can be removed where necessary by some finishing operation such as polishing. It is suggested that metal removal is effected by thermal rather than purely mechanical means.

4348 Some Effects of Lubricants in Cold Rolling Thin Strip. J. C. Whetzel, Jr. and Charles Wyle. *Metal Progress*, v. 70, Dec. 1956, p. 73-76.

The max. reduction of thin strip can be increased from approximately 12 to 62% at the same rolling speed by changing the lubricant.

4349* Evaluating Cutting Fluids. C. D. Flemming and L. H. Sudholz. *Ordnance*, v. 41, Jan.-Feb. 1957, p. 719-721.

Tapping test permits performance prediction under service conditions.

4350* (French.) The Pressing of Metals and Light Alloys. **L'emboutissage des métaux et alliages légers.** Robert Chopin. *Revue de l'Aluminium*, v. 33, no. 236, Oct. 1956, p. 943-948.

The evoluton of deep drawing since 1936, hydraulic forming techniques, and spinning processes are reviewed.

4351 Constricted Tungsten-Arc Cutting of Aluminum. G. W. Oyler, R. L. O'Brien, and J. Maier, III. *Welding Journal*, v. 35, Dec. 1956, p. 1214-1221.

High-quality saw-like cuts can be made in Al, Mg, and Cu, using a mixture of 65% A-35% H gas for machine cutting and 80% A-20% H for manual work. The intense heat of the constricted W-arc melts the metal which is then mechanically removed by the gas stream. A d. c. open-circuit voltage of 100 v. is required, and separate controls and torches are used for manual and mechanized operations. Metallographic examination of welds in saw-cut and arc-cut plate shows no significant difference in weld soundness. The process can be used in any position for cutting straight lines, levels, circles, and shapes, and with considerable increase in speed.

4352 The Control of Insulated Wire Diameter. Charles M. Fredrickson and Charles D. Gibbs. *Wire and Wire Products*, v. 31, Dec. 1956, p. 1453-1455, 1494-1497.

Results of tests made on automatic diameter control devices.

See also: **3720** (automatic control in machining); **3782** (rolling mill electric system); **4099** (friction between steel slabs and roller conveyors); **4404** (rolling of steel sheet); **4779** (rolling U sheet).

METALS—METALLOGRAPHY, TRANSFORMATIONS, AND STRUCTURES

4353 (English.) **A Contribution to the Analysis of the Effects Observed on Heating Gold in Air. I-II.** A. F. Modie. *Acta Crystallographica*, v. 9, pt. 12, Dec. 1956, p. 995-1001.

Data on diffraction patterns obtained from thin Au films. Basic framework of structure of surface compounds. A model based on the disposition of gas atom in the tetrahedral holes of the Au lattice.

4354* (English.) **Phase Transformations in Iron–Platinum Alloys Near the Composition Fe_3Pt.** A. E. Berkowitz, F. J. Donahoe, A. D. Franklin, and R. P. Steijn. *Acta Metallurgica*, v. 5, no. 1, Jan. 1957, p. 1-12.

4355* (English.) **Surface Migraton on Tantalum Crystals Under Influence of Electric and Thermal Gradients.** David B. Langmuir. *Acta Metallurgica*, v. 5, no. 1, Jan. 1957, p. 13-23.

Grains in a thin Ta ribbon with (112) surfaces exposed develop two distinct types of surface structure when heated in vacuum with d.c. for a few hundred hrs. at 2150 K. Phenomena is explained according to differences in rates of drift of atoms and ions.

4356* (English.) **Self-Diffusion and Interdiffusion in Gold-Nickel Alloys.** J. E. Reynolds, B. L. Averbach, and Morris Cohen. *Acta Metallurgica*, v. 5, no. 1, Jan. 1957, p. 29-40.

The Darken equation, relating the interdiffusion coefficient to the self-diffusion coefficients and the chemical potential gradient, was verified experimentally. Influence of the thermodynamic factor on the activation energy for interdiffusion is shown.

4357* (Russian.) Shape of Graphite Inclusions in Magnesium Modified Cast Iron. **O forme grafitnykh vkliuchenii v modifitsirovannykh magniem chugunakh.** K. P. Bunin, Iu. M. Taran, and T. M. Shpak. *Akademiia Nauk Ukrains'koi RSR, Dopovidi*, no. 5, 1956, p. 446-449.

Investigation of spherical pores in austenite and their change after annealing. Role of Mg.

4358* (Russian.) Distribution of Silicon Between the Phases in White Cast Iron. **O raspredelenii kremniia mezhdu fazami v belom chugune.** I. E. Lev. *Akademiia Nauk Ukrains'koi RSR, Dopovidi*, no. 5, 1956, p. 446-49.

Silicon is concentrated during crystallization in the solid solution but not in cementite of Fe-C-Si alloys.

4359 Tabulation, Bibliography, and Structure of Binary Intermetallic Compounds. I. Compounds of Lithium, Sodium, Potassium, and Rubidium. S. G. Epstein, D. M. Bailey, R. L. Smythe, G. R. Kilp, and J. F. Smith. *Ames Laboratory (U. S. Atomic Energy Commission)*, ISC-795, Sept. 1956, 31 p. (UF767 Un3.1is Contin.)

A compilation of 94 references.

4360* (German.) Appearance of Cubic Nitride in Aluminum Alloyed Steels. **Das Aufreten eines kubischen Nitrids in aluminiumlegierten Stählen.** Walter Koch, Christa Ilschner-Gensch, and Helga Rohde. *Archiv für das Eisenhüttenwesen*, v. 27, no .11, Nov. 1956, p. 701-706.

Investigation of nitrided steel structure in various layers by means of nondestructive methods.

4361* (German.) Recrystallization of Nickel-Chromium and Iron-Nickel-Chromium Alloys. **Rekristallisationsuntersuchungen an Nickel-Chrom und Eisen-Nickel-Chrom-Legierungen.** Hannelore Kofler-Valencak and Helmut Krainer. *Archiv für das Eisenhüttenwesen*, v. 27, no. 11, Nov. 1956, p. 725-730.

Investigation of 80% Ni and 20% Cr, and 30% Ni and 20% Cr steel alloys at 500 to 1100 C, by measurement of electrical resistance, tensile strength and elongation at rupture, as well as observation of the recrystallization structure.

4362* (German.) The Emanation Method and Autoradiographic Processes in Metallography and Metallurgy. **Emaniermethode und autoradiographische Verfahren in Metallkunde und Metallurgie.** G. Glawitsch and G. F. Hüttig. *Berg- und Hüttenmännische Monatshefte der Montanistischen Hochschule in Leoben*, v. 101, no. 11, Nov. 1956, p. 232-238.

4363 Effect of Superheating of Molten Steel Upon Its Crystallization. D. S. Kamenetskaya, I. B. Piletskaya, and E. P. Rakhmanova. *Henry Brutcher Translation No.* 3833, 7 p. (From *Fizika Metallov i Metallovedenie*, v. 2, no. 2, 1956, p. 254-258.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 13222, v. 5, Oct. 1956.

4364* (French.) Solidification Curve of Sodium-Gallium Alloys. **Diagramme de solidification des alliages sodium-gallium.** Pierre Feschotte and Emile Rinck. *Comptes Rendus*, v. 243, no. 2, Nov. 12, 1956, p. 1525-1528.

Sodium has high affinity for gas with which it unites with heat emission, producing two definite compounds which melt at high temperature and correspond to Na_3Ga_5 and $NaGa_2$.

4365* (French.) The Various Forms of Graphite Found in Unalloyed Gray Pig Irons. **Les différentes formes de graphite rencontrées dans les fontes grises non alliées.** M. Michel Ferry. *Fonderie*, no. 129, Oct. 1956, p. 395-415.

Five types of graphite were determined, in an approximate manner, according to their compositions, C and Si contents, thickness, and pouring temperature.

4366 A Study of the Hydrogen-Pressure Relationships in the Zirconium-Hydrogen System. C. E. Ells and A. D. McQuillan. *Institute of Metals, Journal*, v. 85, Nov. 1956, p. 89-96.

Measurements of H equilibrium pressure for a series of Zr-H alloys in the composition range 1 to 44 at.% H at temperatures between 500 and 950 C were used to deduce the form of part of the constitutional diagram for the Zr-H system.

4367 The Constitution of Copper-Rich Alloys of the Copper-Manganese-Aluminium System. D. R. F. West and D. Lloyd Thomas. *Institute of Metals, Journal*, v. 85, Nov. 1956, p. 97-104 + 1 plate.

The constitution of Cu-based alloys containing approximately 0 to 30 wt.% Mn and 0 to 18 wt.% Al was determined within the temperature range 800 to 400 C, and results are presented in the form of isothermal sections.

4368 Lattice Spacings of the Silver-Rich Solid Solution Containing Magnesium and Antimony. R. B. Hill and H. J. Axon. *Institute of Metals, Journal*, v. 85, Nov. 1956, p. 109-112.

Measurements indicate the Ag-rich solid solution comes into equilibrium with three compound phases; electron compound Ag-Sb, ternary compound AgMgSb, and the binary compound Mg_3Sb_2.

4369 Microstructure: Guide to Better Alloys. W. R. Hibbard, Jr. *Iron Age*, v. 178, Dec. 20, 1956, p. 75-77.

The value of microstructure in improving properties is demonstrated in the development of Ti alloys.

4370 Bainitic Retained Austenite. "Conditioning" in En 40C and Occurrence in Other En Steels. J. A. Cameron. *Iron & Steel*, v. 29, Dec. 1956, p. 631-633.

4371 Tempering of Plain Carbon Steels. E. D. Hyam and J. Nutting. *Iron & Steel*, v. 29, Dec. 1956, p. 638-644.

Structures produced in the fourth stage of tempering. The cementite particles are approximately spheroidal, are noncoherent with the ferrite matrix, and not only can their amount be varied by use of a steel of different C content but their degree of dispersion can also be varied over an extremely wide range by suitable adjustment o fa simple heat-treatment process.

4372 Fourth Stage of Tempering Electron Microscopic Examination of Alloy Carbide Precipitated. Kehsin Kuo. *Iron & Steel*, v. 29, Dec. 1956, p. 645-650.

4373 The Calculation of Transformation Temperatures and Austenite-Ferrite Equilibria in Steels. K. W. Andrews. *Iron and Steel Institute, Journal*, v. 184, Dec. 1956, p. 414-427.

4374* (Russian.) The Effects of Deformation on the Graphitization of Iron Alloys. **O vliianii deformatsii na grafitizatsiiu zheleznykh splavov.** K. P. Bunin and S. N. Ivanov. *Izvestiia Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk*, no. 10, Oct. 1956, p. 3-14.

Studies made on white cast iron modified with Mg shows chief cause of increased graphitization after deformation is the formation of small fractures in the crystal matrix. The formation and growth of graphite proceeds rapidly during tempering.

4375* (Russian.) The Mechanism of Intermediate Austenite Transformation. **O mekhanizme promezhutochnogo prevrashcheniia austenita.** B. A. Leont'ev and L. S. Palatnik. *Izvestiia Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk*, no. 10, Oct. 1956, p. 28-36 + 2 plates.

Electron-microscope studies of the structure of Zokhma, 5552, and ShKh 15 steels. Explains details of decomposition in the transition region and gives general scheme of the mechanism of transitional transformation.

4376* (Russian.) Determining the Coefficients of Diffusion Within the Grains and at the Grain Boundaries of Metals. **Ob opredelenii koeffitsientov diffuzii v ob'eme i po granitsam zeren metallov.** V. T. Borisov, V. M. Golikov, and B. Ia. Liubov. *Izvestiia Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk*, no. 10, Oct. 1956, p. 37-47.

Theoretical basis and practical application of a radioactive absorption method for determining diffusion coefficients.

4377 Dislocation Etch Pits in Silicon Crystals. F. L. Vogel, Jr. and L. Clarice Lovell. *Journal of Applied Physics*, v. 27, Dec. 1956, p. 1413-1415.

An $HF:HNO_3$ etch was used to observe low angle boundaries, slip lines, polygonization walls, and bent crystal distributions.

4378 Diffusion of Aluminum in Single Crystal Silicon. R. C. Miller and A. Savage. *Journal of Applied Physics*, v. 27, Dec. 1956, p. 1430-1432.

4379 Structure of Bent Zinc Crystals. C. T. Wei and Paul A. Beck. *Journal of Applied Physics*, v. 27, Dec. 1956, p. 1508-1518.

Structure of crystals bent by wrapping around a mandrel and by impressing a sharp needle in a direction perpendicular to the basal plane was studied by means of appropriate X-ray diffraction techniques.

4380* (French.) On the Morphology of Superficial Oxide Films. **Sur la morphologie des pellicules superficielles d'oxydation.** R. Collongues and R. Sifferlen. *Journal de Chimie Physique*, v. 53, no. 10, Oct. 1956, p. 803-809.

Study of the structure produced by electrolytic polishing crystals of FeO and Cu_2O. The structural state of these crystals is very close to the polygonized state of the metals.

4381* (German.) Determination of Crystal Orientation in Copper, Bronze and Brass by the Cross-Hatching Method. **Zur Orientierungsbestimmung der Kristalle bei Kupfer, Bronze und Messing durdh die Schraffur.** H. Klemm. *Metall*, v. 10, nos. 23-24, Dec. 1956, p. 1117-1125.

Microscopic and sodium sulfate methods are described. Application to Al alloys.

4382 Isothermal and Continuous-Cooling Transformation Diagrams of Steels. II. G. Mayer. *Metal Treatment and Drop Forging*, v. 23, Dec. 1956, p. 495-498.

Determination of continuous-cooling diagrams. Comparison of isothermal and continuous-cooling transformation data.

4383* (French.) Formation of Epitaxic Layers Under the Influence of Air and Anode Oxidation as an Aid in the Micrographic Examination of Uranium. **Examen micrographique de l'uranium par formation de couches épitaxiques par oxydation atmosphérique et oxydation anodique.** A. Robillard, R. Boucher, and P. Lacombe. *Métaux, Corrosion-Industries*, v. 31, no. 375, Nov. 1956, p. 433-443 + 2 plates.

Air and anode oxidation reveals the relative orientation of the grains, twins, and deformation bands. Results and advantages of both methods.

4384* (French.) Micrographic Attack of Uranium by Chemical Oxidation. **Attaque micrographique de l'uranium par oxydation chimique.** H. Monti and J. Bloch. *Métaux, Corrosion-Industries*, v. 31, no. 375, Nov. 1956, p. 444-450 + 2 plates.

Oxidation of specimens for metallographical examination.

4385* (French.) Excessive Grain Growth. **La croissance exagérée du grain.** P. Coulomb. *Métaux, Corrosion-Industries*, v. 31, no. 375, Nov. 1956, p. 451-456.

A critical survey of research on grain growth produced by marked primary recrystallization or by the gradual disappearance of recrystallization texture during annealing. Secondary recrystallization of soft iron.

4386 Self Diffusion in Thorium. C. J. Meechan. *North American Aviation, Inc. (U. S. Atomic Energy Commission)*, NAA-SR-1714, Dec. 1956, 20 p. (UF767 Un3.1na Contin.)

Coefficients for Th were determined from sintering data for both the face-centered-cubic and body-centered-cubic phases.

4387 The Self-Energy and Interaction Energy of Stacking Faults in Metals. R. W. Attree and J. S. Plaskett. *Philosophical Magazine*, v. 1, ser. 8, no. 10, Oct. 1956, p. 885-911.

Self-energy of a fault in a monovalent metal is found to be about 20 ergs per sq. cm. Interaction energy is about 0.4 ergs per sq. cm. when the faults are one lattice plane apart and negligible when they are further apart.

4388 Stacking Faults in Cold-Worked Cobalt-Nickel Alloys. J. W. Christian and J. Spreadborough. *Philosophical Magazine*, v. 1, ser. 8, no. 11, Nov. 1956, p. 1069-1075.

Stacking fault parameters. A possible correlation between production of faults and abnormally large increases in electrical resistivity on cold-working, and large work-hardening capacities, shown by certain alloys of critical composition.

4389 (French.) The Structure of Metallic Uranium. **Sur la structure de l'uranium métallique.** J. Friedel. *Physics and Chemistry of Solids*, v. 1, Nov. 1956, p. 175-187.

Various properties of U in its α, β, and γ-phase indicate that it is a transitional metal, with probably about one electron per atom in a narrow and almost empty energy band. The strongly covalent charater of the interatomic bindings, especially in the α-phase, suggests that 3 to 4 electrons per atom fill completely a second narrow band.

4390* (English.) **The Energy Band Structure of Metallic Copper—The Orthogonalized Plane Wave Method.** Mitsuru Fukuchi. *Progress of Theoretical Physics*, v. 16, Sept. 1956, p. 222-230.

Structure is computed by using Hartree's self-consistent field of Cu + ion cores and Slater's approximate exchange potential.

4391* (German.) Peritectic Reaction of the Binary Fe-C System During the Transformation Into the Ternary Fe-C-P System. **Der Verlauf der peritektischen Reaktion des binären Systems Fe-C beim Übergang ins ternäre System Fe-C-P.** P. H. Tütsch. *Schweizer Archiv für Angewandte Wissenschaft und Technik*, v. 22, no. 11, Nov. 1956, p. 345-355.

Shows theoretically the possible reactions in the Fe-C-P system. Presents and interprets microstructures in the system.

4392* (Russian.) Reaction Between Titanium Carbide and the Metals of the Iron Group. **Uzaimodeistvie karbida titana s metallami semeistva zheleza.** V. N. Eremenko. *Zhurnal Neorganicheskoi Khimii*, v. 1, no. 9, Sept. 1956, p. 2131-2148.

Thermal, metallographic, dilatometric, and X-ray investigation of alloys of TiC with Fe, Co, and Ni. Phase diagrams.

4393* (Russian.) Construction of Melting Diagrams for the System Fr-Ni-Cu-Mn-Cr. **Postroenie orientirovochnykh diagram plavkosti sistemy Fe-Ni-Cu-Mn-Cr.** F. M. Perel'man. *Zhurnal Neorganicheskoi Khimii*, v. 1, no. 11, Nov. 1956, p. 2577-2587.

Method of construction for four and five component systems by projecting geometrical figures presenting compositions on one of the coordinate planes.

See also: **3476** (nitrides in steels); **3809** (structure of electropolished Cr and brass); **4272** (diffusion in brass); **4298** (recrystallization of Ti alloys); **4309** (grain boundary segregation in brass); **4415** (metallographic uses of radioisotopes).

METALS—POWDER

4394 Carbonitride to Step up Powder Iron Properties. Lars Troberg. *Iron Age*, v. 179, Jan. 10, 1957, p. 66-68.

Tests with both high and medium density powders showed value of carbonitriding where higher hardness and hardenability are called for.

4395* (Hungarian.) Prospects for the Development of the Production of Metal Powders During the Second Five-Year Plan. **A fémporgyártás fejlődésének perspektívái a második ötéves terv időszakában.** Miklos Hauska. *Kohászati Lapok*, v. 11, no. 9, Sept. 1956, p. 423-428.

Present problems in metal-powder production; applications; economic considerations; problems for research and development.

4396 Infiltration of Cermets for Improved Toughness. Claus G. Goetzel and John B. Adamec. *Metal Progress*, v. 70, Dec. 1956, p. 101-106.

Composite structures produced by impregnating porous TiC compacts with a metallic binder have better impact strength and oxidation resistance than conventional cermets.

4397 A New Oil-Less Bearing Material. John D. Shaw and Walter V. Knopp. *Product Engineering*, v. 28, Jan. 1957, p. 203-205.

Characteristics and properties, advantages and limitations of full density graphite-metal powder combinations, self-lubricating even at extreme temperatures and pressures.

NONDESTRUCTIVE TESTING AND QUALITY CONTROL

4398* Magnetic Memory Links. Continuous Inspection and Sorting. Thomas G. Slattery and Arthur Joyce. *Automation*, v. 4, Jan. 1957, p. 75-80.

Processing line operating at high speed has memory device between remotely located inspection and sorting stations so that material classed as defective can be diverted from regular flow.

4399* (Russia.) Ultrasonic Testing of Fillet Welds. **Kontrol' kachestva uglovykh shvov l'trazvukom.** A. K. Gurvich. *Avtomaticheskaia Svarka*, v. 9, no. 5, Sept.-Oct. 1956, p. 84-89.

Consideration of ultrasonic tests on fillet welds to reveal pores, slag inclusions, cracks and incomplete fusion in the joints. Manner of performing the tests on the vertical sections of beams and channels.

4400* (Dutch.) X-Ray Image Amplifier for the Examination of Thick Materials. **Röntgenbeeldversterker voor doorlichting vab dikke materialen.** *Bedrijf en Techniek*, v. 11, no. 267; *Electronica section*, v. 9, no. 214, Dec. 1, 1956, p. 185, 187, 189, 191.

Study of an X-ray amplifier increasing the image brightness 1000 times. Various applications to industry, especially in relation to the examination of high absorption materials such as steel parts over 10 mm. thick.

4401* (German.) Some Applications of Isotopes in the Iron and Steel Industry. **Anwendungsbeispiele der Isotopenuntersuchung in der Eisen- und Stahlindustrie.** Helmut Krainer. *Berg- und Hüttenmännische Monatshefte der Montanistischen Hochschule in Leoben*, v. 101, no. 11, Nov. 1956, p. 246-255.

Use of radioactive isotopes as source of rays in nondestructive testing. Comparison of γ- and X-ray methods. Phosphorus increase in steel was examined by the autoradiographic method. Abrasion and wear measurements with radioactive tools.

4402 Nickel Depth Meter. G. D. Linsey. *Hanford Atomic Products Operation (U. S. Atomic Energy Commission)*, HW-44720, July 1956, 18 p. (UF767 Un3.1hw Contin.)

An electronic instrument based on eddy current principles has been developed for measuring the thickness of thin layers of Ni plated onto a non-magnetic base metal.

4403 A Second Look at Radiographic Inspection of Lead Linings During Fabrication. William Skiba. *Mechanical Engineering*, v. 78, Dec. 1956, p. 1125-1127.

Time shows that with γ-ray inspection, defect-free homogeneously bonded lead linings can be produced.

4404 The Detection of Rolling Defects in Steel Sheet. A. M. Armour. *Metallurgia*, v. 54, no. 326, Dec. 1956, p. 301-304.

Review of ultrasonic, mechanical, electrical or magnetic processes. Suggestions are made for improving the speed of the magnetic method, and an alternative mechanical method is described.

4405* **Basic Principles and Techniques of Eddy Current Testing.** H. L. Libby. *Nondestructive Testing*, v. 14, Nov.-Dec. 1956, p. 12-18, 27.

Successful treating is based on causing eddy currents to flow in the test specimen, measurement of the effect of the flow of the eddy currents with an external probe coil, comparison of the flow of eddy currents in the test sample with those in a standard or acceptable sample, or observation of changes in the flow of eddy currents when using the scanning technique, and acceptance or rejection of the test sample on the basis of predetermined limits. A generalized test specimen is developed, a cathode ray *vectorscope* display is described, and typical test results of other schemes are discussed.

4406* **Radiography in Production Control and Inspection of Subminiature Tubes.** Eric A. Kolm. *Nondestructive Testing*, v. 14, Nov.-Dec. 1956, p. 20-23, 27.

Basic requirements are the smallness and the stability of the X-ray source, the constant potential of the voltage across the tube, the adequacy of target cooling, and the ability to mass-radiograph.

4407* **Broad Beam Attenuation Data for 50 to 300 KVP X-Rays.** E. Dale Trout, John P. Kelley, E. J. Furno, and A. C. Lucas. *Nondestructive Testing*, v. 14, Nov.-Dec. 1956, p. 24-27.

At the lower voltages, Pb is a very effective barrier but it may be desirable to use concrete because of ease of installation or for structural reasons.

4408* **A New Nondestructive Test Tool: The Ultrasonic Micrometer.** H. A. F. Rocha. *Nondestructive Testing*, v. 14, Nov.-Dec. 1956, p. 32-34.

The principle of operation of a pulsed ultrasonic distance meter.

4409* (Russian.) Using Radioactive Isotopes in the Building Industry. **Primenenie radioaktivnykh izotopov v stroitel'noi promyshlennosti.** A. A. Dobrinskaia. *Uspekhi Fizicheskikh Nauk*, v. 60, no. 2, Oct. 1956, p. 327-361.

Testing of building materials such as concrete, wood, metals, machine parts, and welding joints.

See also: **3795** (ultrasonic inspection of insulators).

NUCLEAR PHYSICS, NUCLEONICS, AND RADIATION

4410 Accelerating Civilian Reactor Program. 545 p. 1956. United States Government Printing Office, Washington, D. C. (QC786 Un3.24a)

Hearings before the joint committee on atomic energy, congress of the U. S.

4411 The Neutron-Proton System With a Cental Exponential Potential. II. P. O. Brundell and B. Enander. *Acta Polytechnica (Physics Including Nucleonics Series)*, v. 3, no. 3, 1956, 13 p. (Tl Ac81 Vis.)

Photomagnetic and photoelectric cross sections are calculated.

4412 Annual Review of Nuclear Science. James G. Beckerley, Martin D. Kamen, and Leonard I. Schiff, editors. v. VI. 471 p. 1956. Annual Reviews, Palo Alto, Calif. (QC780 An78 Vis.)

Among the subjects reviewed are cosmic rays, fast nucleons, atomic spectra, medium-weight nuclei, radiochemical separations, low level counting, reactors for electric power generation, and cellular and vertebrate radiobiology.

4413 Interpretation of Counting Data. Ellis P. Steinberg. *Argonne National Laboratory (U. S. Atomic Energy Commission)*, ANL-5622, Sept. 1956, 65 p. (UF767 Un3.1an Contin.)

Report is designed as a handy guide to some of the problems involved and the techniques generally employed in avoiding or correcting for them.

4414 Studies of Flow Distribution in the Core of a Quarter-Scale Flow Model of the PWR Reactor. Herbert R. Hazard and John M. Allen. *Battelle Memorial Institute (U. S. Atomic Energy Commission)*, BMI-1141, Oct. 1956, 46 p. (UF 767 U3b Contin.)

Air-flow studies of the model of the PWR reactor have been used to evaluate and prove the adequacy of the flow baffle, which affects distribution of coolant flow throughout the reactor core.

4415* (German.) Relationship Between Nuclear Physics and Metallography. **Beziehungen zwischen Kernphysik und Metallkunde.** Berta Karlik. *Berg- und Hüttenmännische Monatshefte der Montanistischen Hochschule in Leoben*, v. 101, no. 11, Nov. 1956, p. 210-213.

Shows how progress in nuclear-reactor physics depends on progress in metallurgy and metallography, and vice versa. Use of radioactive isotopes in chemical analysis and structure determinations.

4416 Scientific Problems in the Development of Nuclear Power. John Cockcroft. *British Journal of Applied Physics, Supplement No.* 5, 1956, p. 1S-8S.

Review of problems in reactor physics, solid-state physics, and fuel-element processing.

4417 The Physics of Advanced Reactors. J. R. Dietrich. *British Journal of Applied Physics, Supplement No.* 5, 1956, p. 9S-26S.

The various promising types of solid fuel power reactors are characterized in terms of the neutron-physics characteristics of their moderators, coolants, and fuel cycles.

4418 Experimental Reactor Physics. P. W. Mummery. *British Journal of Applied Physics, Supplement No.* 5, 1956, p. 27S-32S.

Basic problems, integral experiments; typical correlations with mathematical models; use of reactor assemblies.

4419 The Zero-Energy Fast Breeder Reactor, Zephyr. L. R. Shepherd. *British Journal of Applied Physics, Supplement No.* 5, 1956, p. 32S-41S.

Zephyr is a small low-power fast reactor with a Pu core surrounded by an envelope of natural U. No cooling is required since the max. operating power is about two w.

4420 The Effects of Irradiation on the Physical Properties of Solids. A. H. Cottrell. *British Journal of Applied Physics, Supplement No.* 5, 1956, p. 43S-53S.

Prolonged bombardments produce drastic effects; some minerals become non-crystalline, U crystals change shape, some metals become brittle, and rare gas atoms created by transmutations may produce swelling and disintegration at high temperatures.

4421 Shielding for Reactors. G. C. Laurence. *British Journal of Applied Physics, Supplement No.* 5, 1956, p. 54S-59S.

Design requirements, choice of materials and dimensions, nuclear reactions that affect the penetration, heating of the shielding, and production of radioactivity in the coolant.

4422 The Control of Reactors. A. J. Salmon. *British Journal of Applied Physics, Supplement No.* 5, 1956, p. 59S-70S.

The concepts of reactivity, neutron lifetime, and delayed neutrons, and their relationships with the rate of change of neutron density and reactor power. Safety considerations.

4423 The Instrumentation of Reactors. W. Macrae. *British Journal of Applied Physics, Supplement No.* 5, 1956, p. 71S-87S.

Basic principles of the instruments used for flux distribution measurements and for detection of faulty fuel containers.

4424 The Canadian Research Reactors and Their Uses. W. B. Lewis. *British Journal of Applied Physics, Supplement No.* 5, 1956, p. 96S-100S.

4425 The Half-Life of Ni^{63}. C. C. McMullen, B. D. Pate, R. H. Tomlinson, and L. Yaffe. *Canadian Journal of Chemistry*, v. 34, Dec. 1956, p. 1742-1746.

Half-life was 125 ± 6 yr. Number of atoms of Ni^{63} was determined mass spectrometrically and the disintegration rate by $4\pi\ \beta$ counting.

4426 Cross Sections of Dissociative Recombination. Ernest Bauer and Ta-You Wu. *Canadian Journal of Physics*, v. 34, Dec. 1956, p. 1436-1447.

An estimation of the general order of magnitude of the cross sections by carrying out a calculation for a hypothetical system.

4427* (French.) A Graphic Scheme for the Levels of Cs^{131}. **Schéma des niveaux du ^{131}Cs.** Hamlet Vartapetian. *Comptes Rendus*, v. 243, no. 2, Nov. 12, 1956, p. 1512-1514.

4428* (French.) Capture of L Electrons in Disintegration of Cobalt 57. **La capture d'électrons L dans la désintégration du cobalt 57.** André Moussa and Andrée Juillard. *Comptes Rendus*, v. 243, no. 2, Nov. 12, 1956, p. 1515-1517.

Direct comparison with the magnetic spectrometer of the number of Auger-K electrons with the number of conversion electrons.

4429 (English.) **Construction of a Spectrometer for Neutrino Recoils: Investigation of the Decay of A^{37}.** O. Kofoed-Hansen and A. Nielsen. 60 p. 1955. København. (QC787.06 K82c)

4430 Electromagnetic Ball Conveyor. Grant H. Strong. *Electrical Engineering*, v. 75, Dec. 1956, p. 1064-1069.

An apparatus for transporting radioactive β steel control balls through a stainless-steel tube. Movement is effected by traveling magnetic waves which pull clusters of balls within them as they progress linearly through the tubes.

4431 A Control System for Research-Type Nuclear Reactors. E. T. Davis, V. S. Underkoffler, and R. N. Brey. *Electrical Engineering*, v. 75, Dec. 1956, p. 1086-1090.

Design of a flexible, low cost, industrial servo system; how this design executes the control functions using temperature as the variable, and how these functions apply to reactor kinetics.

4432* Development of Gas-Cooled Reactors for Power Production. R. V. Moore. *Engineer*, v. 202, Dec. 21, 1956, p. 881-883.

Methods of reducing the cost of electricity generated in power plants based on the gas-cooled graphite-moderated reactor. Effect of fuel temperatures and coolant conditions on performance. Fuel recycling.

4433 Physics: The Magnificent Riddle. Francis Bello. *Fortune*, v. 55, Jan. 1957, p. 121 + 8 pages.

The story behind the some 30 elementary particles which we are aware of today and whose significance no one fully comprehends.

4434 Thermal Stresses in Cylindrical Reactor Fuel Elements. K. R. Merckx. *Hanford Atomic Products Operation (U. S. Atomic Energy Commission)*, HW-42665, Sept. 1956, 28 p. (UF767 Un3.1hw Contin.)

A method of calculating the thermal stresses in cylindrical shapes is developed using a material model relating strain rate, temperature, strain, and stress.

4435 High Energy Nuclear Physics. J. Ballam, V. L. Fitch, T. Fulton, K. Huang, R. R. Rau, and S. B. Treiman, editors. Sections individually paged. 1956. Interscience Publishers, New York. (QC173 H53)

Proceedings of 1956 Rochester Conference. Papers cover recent work on particle production and interactions.

4436* Nuclear Reactors for Power Production. F. M. Greenlees. Institute of Fuel, Journal, v. 29, Dec. 1956, p. 551-566 + 4 plates.

Principles of nuclear fission; the arrangement of British reactors from the Harwell Pile to Calder Hall. Mechanical, electrical, and instrumentation problems. Several alternative types of reactor systems, with estimated outputs in terms of heat and electricity.

4437 Delta-Function Model. I. Electronic Energies of Hydrogen-Like Atoms and Diatomic Molecules. Arthur A. Frost. **II. Aromatic Hydrocarbons.** Arthur A. Frost and Frances E. Leland. *Journal of Chemical Physics*, v. 25, Dec. 1956, p. 1150-1160.

Delta function model is applied to one-electron atoms, diatomic molecules, and pi-electron systems in aromatic molecules with no open chains. The electron in a one-electron atom or diatomic molecule is considered to move in one-dimension on a line through the nuclei. The potential energy is taken as zero except at the nuclei where it goes to minus infinity as negative delta functions.

4438 Search for O^{20}. S. Katcoff and J. Hudis. *Journal of Inorganic and Nuclear Chemistry*, v. 3, Nov. 1956, p. 253-254.

An attempt to detect O^{20} prepared by an $(\alpha, 2p)$ reaction on O^{18} showed that the half-life of O^{20} is not in the range 10 min. to 150 yrs.

4439 Inelastic Cross-Sections for Fission-Spectrum Neutrons. II. H. A. Bethe, J. R. Beyster, and R. E. Carter. *Journal of Nuclear Energy*, v. 3, Nov. 1956, p. 273-300.

Anisotropic scattering and justification of transport approximation; determination of escape probabilities; corrections.

4440 On the Problem of Overshoots in the Control of Nuclear Reactors. J. U. Koppel and H. Schultz. *Journal of Nuclear Energy*, v. 3, Nov. 1956, p. 312-320.

Time-dependent behavior of two reactors, one uncontrolled and the other controlled by means of a specified automatic control system. Conditions ruling out overshoots over the final stationary values of power and temperature. Upper limits of the overshoots when these conditions are not satisfied.

4441 An Investigation of Slow-Neutron-Capture γ Rays From Calcium, Nickel, and Potassium. V. P. Adyasevich, L. V. Groshev, A. M. Demidov, and B. N. Lutsenko. *Journal of Nuclear Energy*, v. 3, Nov. 1956, p. 325-340.

4442 Experiments on the Production of Einsteinium and Fermium With a Cyclotron. L. I. Guseva, K. V. Filippova, Yu. B. Gerlit, V. A. Druin, B. F. Myasoedov, and N. I. Tarantin. *Journal of Nuclear Energy*, v. 3, Nov. 1956, p. 341-346.

Uranium targets were bombarded with quintuply-ionized N and sextuply-ionized O atoms. Half-lives and particle energies were measured with photographic plates, with an ionization chamber having spherical electrodes, and with a twenty-channel pulse analyzer.

4443 The Standardization of Radioactive Preparations. K. K. Aglintsev, F. M. Karavaev, A. A. Konstantinov, G. P. Ostromukhova, and E. A. Kholnova. *Journal of Nuclear Energy*, v. 3, Nov. 1956, p. 347-355 + 1 plate.

Activity was measured by calorimetric, ionization and absolute β-counting methods; Ra-γ equivalent by means of a 4π ionization chamber; and γ dose rate by an ordinary ionization chamber.

4444 On the Nature of Radiation Damage in Fissile Materials. S. T. Konobeevsky. *Journal of Nuclear Energy*, v. 3, Nov. 1956, p. 356-365.

Phase transformations occurring during neutron irradiation; a possible effect of thermal spikes upon the structure of the $\alpha + \gamma'$eutectoid in an annealed U-Mo alloy.

4445 The Passage of γ Rays Through Water, Iron, Lead, and a Combination of Iron and Lead Plates. S. G. Tsypin, V. I. Kukhtevich, and Yu. A. Kazansky. *Journal of Nuclear Energy*, v. 3, Nov. 1956, p. 366-370.

4446 Compounds With Potential Activity Against Lethal Radiations. VII. Methyl and Ethyl Homologs of 1,7-Dihydroxynaphthalene. Ng. Ph. Buu-Hoï and Denise Lavit. *Journal of Organic Chemistry*, v. 21, Nov. 1956, p. 1257-1259.

1-7-Dimethoxynaphthalene undergoes both formylation with dimethylformamide, and Friedel-Crafts acetylation, at position 4. Several methyl and ethyl homologs were synthesized for biological testing as potential agents against lethal radiation, and showed marked antioxidant properties.

4447 A Fast Coincidence System for the Measurement of Short Lifetimes. G. Jones and J. B. Warren. *Journal of Scientific Instruments*, v. 33, Nov. 1956, p. 429-431.

Time separation of associated events is converted to pulse amplitude and sorted on a conventional kicksorter.

4448 The Properties of Phosphoric Acid Solutions of Uranium as Fuels for Homogeneous Reactors. B. J. Thamer. *Los Alamos Scientific Laboratory (U. S. Atomic Energy Commission)*, LA-2043, Mar. 1956, 59 p. (UF767 U3La Contin.)

Information on solubility, radiation stability, vapor pressure, thermal expansion of the liquid phase, and corrosion of the UO_2-H_3PO_4-H_2O system.

4449 Some Safety Considerations of Nuclear Power Reactors. C. D. Boadle. *North East Coast Institution of Engineers & Shipbuilders, Transactions*, v. 73, Dec. 1956, p. 63-86.

Characteristics of reactors. Nature, causes, and effects of mishaps. Protective equipment. Characteristics of more advanced systems.

4450 Summary of APDA Fast Reactor Safety Studies. W. H. Jens. *Nuclear Development Corporation of America (U. S. Atomic Energy Commission)*, NDA-27-16, Oct. 1956, 34 p. (UF767 Un3.1nd Contin.)

Assumptions, important considerations, techniques, and results of a number of such studies made for the APDA fast breeder reactor.

4451* Energy Levels in Pb^{205} From the Decay of Bi^{205}. M. Schmorak, R. Stockendal, J. A. McDonell, and I. Bergström. *Nuclear Physics*, v. 2, Nov. 1956, p. 193-225 + 2 plates.

Energies, spins, and parities of nine excited states in Pb^{205} and the probable energies of eight additional states were established by studies of 14.5-day Bi^{205} decay.

4452* The Energy Levels of Pb^{205}. M. H. L. Pryce. *Nuclear Physics*, v. 2, Nov. 1956, p. 226-238.

Energy levels were calculated on the shell model, regarding Pb^{205} as three holes in the double closed shell nucleus Pb^{209}.

4453* Magnetic Properties of F^{19} in the 197 KeV Nuclear Level. P. B. Treacy. *Nuclear Physics*, v. 2, Nov. 1956, p. 239-253.

Gamma rays were observed from the de-excitation of the second excited state of F^{19} produced by inelastic proton scattering.

4454* Lifetime Measurement by Time to Pulse Height Conversion, Applied to the 517 keV Level of ^{85}Rb. J. G. Siekman. *Nuclear Physics*, v. 2, Nov. 1956, p. 254-258.

4455* Connection Between Scattering and Multiple Production of Particles. S. Z. Belenky. *Nuclear Physics*, v. 2, Nov. 1956, p. 259-266.

Statistical weight of the respective state is calculated with account of mutual interaction of pairs of particles. It is shown that in this case the scattering phase of the interacting particles is involved as a characteristic of the interaction.

4456* Concerning the Number of Different Types of K-Mesons. B. Ioffe, L. Okun, and I. Pomeranchuk. *Nuclear Physics*, v. 2, Nov. 1956, p. 277-280.

The small angle scattering cross-sections of K-mesons by deuterons with and without charge exchange are estimated and their bearing on the question of the number of different types of K-mesons discussed. Possible interpretations are examined for the difference of K-meson scattering by free and bound nucleons.

4457* Trends in Radioactivity - Measuring Instruments. Denis Taylor. *Nuclear Power*, v. 2, Jan. 1957, p. 17-21.

4458 Operation of the ORNL Graphite Reactor and the Low-Intensity Test Reactor—1954. A. F. Rupp and J. A. Cox. *Oak Ridge National Laboratory (U. S. Atomic Energy Commission)*, ORNL-1866, Sept. 1955, 21 p. (UF767 U3o Contin.)

4459 Transmission of Obliquely Incident Gamma-Radiation Through Stratified Slab Barriers. C. D. Zerby. *Oak Ridge National Laboratory (U. S. Atomic Energy Commission)*, ORNL-2224, v. 1, Dec. 1956, 85 p. (UF767 U3o Contin.)

The "straight ahead" analytic solution was obtained by altering the scattering cross section so as to consider energy degradation without deflection.

4460 Proton-Excited Energy Levels in ^{14}N. E. J. Burge and D. J. Prowse. *Philosophical Magazine*, v. 1, ser. 8, no. 10, Oct. 1956, p. 912-917.

Nuclear energy levels were investigated up to an energy of 7.7 m.e.v. by inelastic proton scattering.

4461 Density Changes in Neutron Irradiated Quartz. P. G. Klemens. *Philosophical Magazine*, v. 1, ser. 8, no. 10, Oct. 1956, p. 938-941.

4462 The Ratio of K-Capture to Positron Emission in Fluorine 18. R. W. P. Drever, A. Moljk, and J. Scobie. *Philosophical Magazine*, v. 1, ser. 8, no. 10, Oct. 1956, p. 942-948.

4463 The Reaction ^9Be (α,n) ^{12}C. D. B. James, G. A. Jones, and D. H. Wilkinson. *Philosophical Magazine*, v. 1, ser. 8, no. 10, Oct. 1956, p. 949-963.

Angular properties of the reaction in the range E_α=0.4 to 1.3 m.e.v. Analysis in terms of overlapping resonances led to tentative assignments of spin and parity in C^{13}.

4464 Gamma Radiation From the Decay of $^{238}Pu_{94}$, $^{243}Cm_{95}$ and $^{242}Cm_{96}$. J. O. Newton, B. Rose, and J. Milsted. *Philosophical Magazine*, v. 1, ser. 8, no. 11, Nov. 1956, p. 981-1002.

4465 The Elastic Scattering of 136 MeV Neutrons by Nuclei. C. P. Van Zyl, R. G. P. Voss, and R. Wilson. *Philosophical Magazine*, v. 1, ser. 8, no. 11, Nov. 1956, p. 1003-1012.

Neutron elastic scattering cross sections for Pb, Cd, Cu, Al, O, N, C, Be, and Li were measured for an effective neutron energy of 136 m.e.v.

4466 The Nuclear Radius and Potential From Neutron Diffraction Scattering. Richard Wilson. *Philosophical Magazine*, v. 1, ser. 8, no. 11, Nov. 1956, p. 1013-1026.

Considers the value of the differential cross section extrapolated to zero angle, and the width of the diffraction pattern.

4467 An Investigation of Neutrons From the Reaction ^{10}B (d,n) ^{11}C at 1.08 m.e.v. Bombarding Energy. A. Graue. *Philosophical Magazine*, v. 1, ser. 8, no. 11, Nov. 1956, p. 1027-1030.

Relative importance of stripping and compound nucleus formation. The angular momentum of protons captured by the stripping process.

4468 Isotopic Spin Selection Rules. VIII. Charge Independence and the Comparison of Isobaric Triplets. D. H. Wilkinson. *Philosophical Magazine*, v. 1, ser. 8, no. 11, Nov. 1956, p. 1031-1042.

4469 The Nuclear Surface. T. H. R. Skyrme. *Philosophical Magazine*, v. 1, ser. 8, no. 11, Nov. 1956, p. 1043-1054.

The basic ideas of Brueckner's self-consistent nuclear model are applied in a simplified, approximate form to the case of a finite nucleus.

4470 The Nuclear Spin-Orbit Coupling. J. S. Bell and T. H. R. Skyrme. *Philosophical Magazine*, v. 1, ser. 8, no. 11, Nov. 1956, p. 1055-1068.

The empirically determined spin-orbit part of the scattering amplitude is used to find the effective single-particle spin-orbit coupling.

4471 (English.) **Nuclear Reactions.** *Physica*, v. 22, no. 11, Nov. 1956, p. 941-1123.

A symposium of 17 papers including the subjects; compound nucleus formation, stripping reactions, Brueckner theory, neutrons and nuclear structure, Coulomb excitation, capture reactions, spallation and heavy ion reactions, and fission.

4472 Angular Momentum Distributions in the Thomas-Fermi-Dirac Model of the Atom. Thomas A. Oliphant, Jr. *Physical Review*, v. 104, ser. 2, Nov. 15, 1956, p. 954-958.

4473 Stopping Power of Various Gases for Lithium Ions of 100-450-kev Kinetic Energy. Samuel K. Allison and C. S. Littlejohn. *Physical Review*, v. 104, ser. 2, Nov. 15, 1956, p. 959-961.

Power is measured in H_2, He, air, and A.

4474 Coulomb Excitation of Medium-Weight Nuclei. G. M. Temmer and N. P. Heydenburg. *Physical Review*, v. 104, ser. 2, Nov. 15, 1956, p. 967-980.

Gamma-ray transition in nuclei from Ti to Cs, excited by α particles.

4475 Coulomb Excitation and Cascade Decay of Rotational States in Odd-Mass Nuclei. N. P. Heydenburg and G. M. Temmer. *Physical Review*, v. 104, ser. 2, Nov. 15, 1956, p. 981-989.

Studies of Eu-151, Eu-153, Gd-155, Gd-157, Tb-759, Ho-165, Lu-175, Hf-177, Hf-179, and Ta-181.

4476 Contribution of Coulomb Excitation to Inelastic Scattering Between Nuclear Resonances. G. M. Temmer and N. P. Heydenburg. *Physical Review*, v. 104, ser. 2, Nov. 15, 1956, p. 989-992.

4477 Neutron Cross Sections of Zinc. D. A. Dahlberg and L. M. Bollinger. *Physical Review*, v. 104, ser. 2, Nov. 15, 1956, p. 1006-1008.

Determinations on five Zn isotopes.

4478 Nucleon Transfer and Virtual Coulomb Excitation. G. Breit and M. E. Ebel. *Physical Review*, v. 104, ser. 2, Nov. 15, 1956, p. 1030-1046.

Experiments on transfer reactions arising in the collision of N^{14} with N^{14}.

4479 Energy Distribution of Mass-97 Fission Fragments From Thermal-Neutron Fission of Uranium-235. Bernard L. Cohen, Anna Foner Cohen, and Charles D. Coley. *Physical Review*, v. 104, ser. 2, Nov. 15, 1956, p. 1046-1053.

4480 Spin-Orbit Interaction in Nclei. L. S. Kisslinger. *Physical Review*, v. 104, ser. 2, Nov. 15, 1956, p. 1077-1085.

Above is derived in terms of the 2-body interaction between nuclear particles.

4481 Dispersion Relations for Fixed-Source Meson Theories. Abraham Klein. *Physical Review*, v. 104, ser. 2, Nov. 15, 1956, p. 1131-1136.

4482 Dynamical Theory of *K* Mesons. Julian Schwinger. *Physical Review*, v. 104, ser. 2, Nov. 15, 1956, p. 1164-1172.

Several points of analogy exist between the π field and the electromagnetic field.

4483 High-Frequency Scattering. Tai Tsun Wu. *Physical Review*, v. 104, ser. 2, Dec. 1, 1956, p. 1201-1212.

Mathematical treatment of the scattering of a plane electromagnetic wave by a perfectly conducting circular cylinder or a perfectly conducting sphere, the acoustic scattering by a rigid sphere, and the quantum-mechanical scattering by an impenetrable sphere.

4484 Čerenkov Radiation of Neutral Particles With a Magnetic Moment. N. L. Balazs. *Physical Review*, v. 104, ser. 2, Dec. 1, 1956, p. 1220-1222.

A simple expression is deduced for the Čerenkov radiation caused by magnetic and electric dipoles. The effect is very small. In the visible spectrum for a fast neutron, the energy loss per unit path per unit frequency range is about 10^{-15} times that of a fast electron.

4485 Analytical Representation of Hartree Potentials and Electron Scattering. William J. Byatt. *Physical Review*, v. 104, ser. 2, Dec. 1, 1956, p. 1298-1300.

Analytical fits to the Hartree curves of 19 neutral atoms are presented. These are in the form of either Wentzel potentials, for lighter elements, or a series of Wentzel-like terms, for heavier elements. Applications to the scattering of electrons by atoms.

4486 Radial Configurational Interaction in Helium and Similar Atomic Systems. E. Holøien. *Physical Review*, v. 104, ser. 2, Dec. 1, 1956, p. 1301-1303.

The spherically symmetric component of the ground-state wave functions of the two-electron series (H-, He, Li^+, Be^{2+}, C^{4+}, O^{6+}, and Ne^{8+}) was investigated by using the orthonormal complete set of $(2q+2)$-order associated Laguerre functions as radial orbitals in the method of superposition of configurations.

4487 Scattering of 7.5-Mev Protons by Helium. T. M. Putnam, J. E. Brolley, Jr., and Louis Rosen. *Physical Review*, v. 104, ser. 2, Dec. 1, 1956, p. 1303-1306.

The differential cross section for the elastic scattering of 7.5 ± 0.1 m.e.v. protons from He was measured at 2.5° intervals over the laboratory angular range 10 to 172.5° using the Los Alamos nuclear plate camera.

4488 (p,d) and (p,α) Reactions in Be^9. G. Weber, L. W. Davis, and J. B. Marion. *Physical Review*, v. 104, ser. 2, Dec. 1, 1956, p. 1307-1313.

Excitation curves for the Be^9 (p,d) Be^8 (ground state) reaction were measured at observation angles of 15, 45, 70, 90, 110, and 135° for proton energies between 0.8 and 3.0 m.e.v. These curves show pronounced resonance structure and strong interference effects between different levels.

4489 New Isotopes of Einsteinium. Bernard G. Harvey, Alfred Chetham-Strode, Jr., Albert Ghiorso, Gregory R. Chappin, and Stanley G. Thompson. *Physical Review*, v. 104, ser. 2, Dec. 1, 1956, p. 1315-1319.

The new isotopes E^{249}, E^{250}, E^{251}, and E^{252} were produced by bombardment of Bk^{249} with He ions. A recoil method was used to separate the bombardment products from the target material, so that the target could be used repeatedly.

4490 Interaction of 1.0-, 1.77-, 2.5-, 3.25-, and 7.0-Mev Neutrons With Nuclei. J. R. Beyster, M. Walt, and E. W. Salmi. *Physical Review*, v. 104, ser. 2, Dec. 1, 1956, p. 1319-1331.

The differential cross sections for elastic scattering of 2.5-m.e.v. neutrons by Al, Fe, Zr, Sn, Ta, and Bi were measured over the angular range from 15 to 160°. At 7.0 m.e.v. similar measurements were made for Be, C, Al, Fe, Zr, Sn, Ta, and Bi at angles ranging from 12 to 150°. Inelastic collision cross sections were determined by sphere transmission measurements for a number of elements.

4491 Corrections to Internal Conversion Coefficients for Low-*Z* Elements. George W. Hinman. *Physical Review*, v. 104, ser. 2, Dec. 1, 1956, p. 1332-1333.

The internal conversion coefficients for γ-rays depend only on the value of the initial-state wave function at the origin, to a good approximation for light nuclei and high energies where the relativistic approximation of Dancoff and Morrison is valid. Corrections for shielding can be made in this region by using the many calculations available of Hartree-Fock electron wave functions.

4492 (γ,n) Cross Sections of Nuclides near Neutron Number 50. Paul F. Yergin and Burton P. Fabricand. *Physical Review*, v. 104, ser. 2, Dec. 1, 1956, p. 1334-1339.

Measurements of the (γn) cross sections of the nuclides, Sr^{86}, Sr^{87}, Sr^{88}, Y^{89}, and Zr^{92}, together with earlier measurements for the nuclides Zr^{90}, Zr^{91}, and Nb^{93}, show a pronounced narrowing of the giant dipole resonances in the region of neutron number 50, the narrowest resonances being those for the 50-neutron nuclides.

4493 Low-Lying *T*=O Levels in P^{30}. L. L. Lee, Jr. and F. P. Mooring. *Physical Review*, v. 104, ser. 2, Dec. 1, 1956, p. 1342-1343.

The $S^{32}(d,\alpha)P^{30}$ reaction was studied by magnetic analysis. A ground state Q value of 4.831 ± 0.013 m.e.v. was measured, with excited states at 0.693, 1.440, and 1.97 m.e.v. excitation. The prominence of the 0.693- m.e.v. level in this reaction indicates that it is probably T=O, if isotopic spin selection rules may be considered valid.

4494 Ultrasonic Excitation of Nuclear Magnetic Energy Levels of Na^{23} in NaCl. W. G. Proctor and W. A. Robinson. *Physical Review*, v. 104, ser. 2, Dec. 1, 1956, p. 1344-1352.

The nuclear magnetic levels of Na^{23} in a single crystal of NaCl placed in a strong magnetic field was saturated by the pure quadrupole transition $\Delta m=2$, caused by ultrasonic excitation. The observed transition rate was compared with theoretical expressions to find that the electric field gradient generated at the nuclear site by the lattice distortion is very close to that expected from a simple classical model.

4495 Slow-Neutron Capture Gamma Rays From Sodium and Cadmium. Henry T. Motz. *Physical Review*, v. 104, ser. 2, Dec. 1, 1956, p. 1353-1364.

A thin-lens magnetic spectrometer was used to observe the external conversion spectra of $Na^{23}(n,\gamma)$ Na^{24} and $Cd^{113}(n,\gamma)$ Cd^{114} and the internal conversion spectrum of $Cd^{113}(n,\gamma)$ Cd^{114} in the energy range of 300 k.e.v. to 3 m.e.v.

4496 Spin and Magnetic Moment of Mn^{53}. W. Dobrowolski, R. V. Jones, and C. D. Jeffries. *Physical Review*, v. 104, ser. 2, Dec. 1, 1956, p. 1378-1380.

The microwave resonance hyperfine structure of Mn^{53} was observed in a powdered sample of $MnCl_2$ diluted with $SrCl_2$ at 3 cm. wavelength and 20 K.

4497 Effect of the Finite Nuclear Size on Internal Conversion. E. L. Church and J. Weneser. *Physical Review*, v. 104, ser. 2, Dec. 1, 1956, p. 1382-1386.

It is shown that the finite nuclear size introduces additional nuclear matrix elements into the expression for the rate of internal-conversion-electron ejection which are distinctly different from that for γ-ray emission of the same multipole order.

4498 Elastic Scattering of Protons by Beryllium. Forrest S. Mozer. *Physical Review*, v. 104, ser. 2, Dec. 1, 1956, p. 1388-1398.

Fifteen angular distributions and three excitation curves for the reaction $Be^9(p,p)$ were obtained in the proton energy region between 200 and 3000 k.e.v.

4499 Compound Elastic Scattering of Neutrons. W. S. Emmerich and R. M. Sinclair. *Physical Review*, v. 104, ser. 2, Dec. 1, 1956, p. 1399-1401.

The complex potential model predicts a division of the average neutron elastic scattering cross section into shape and compound scattering. The normalized differential elastic cross sections calculated from this model are expanded in a series of Legendre polynomials and compared with data derived from experiments, demonstrating the presence of compound elastic scattering.

4500 Study of the $Li^6(p,\alpha)$ He^3 Reaction. J. B. Marion, G. Weber, and F. S. Mozer. *Physical Review*, v. 104, ser. 2, Dec. 1, 1956, p. 1402-1407.

Studies by observing the magnetically analyzed He^3 and α particles at laboratory angles of 20 and 60°.

4501 Gamma Radiation From Co^{56} and Co^{58}. C. Sharp Cook and F. M. Tomnovec. *Physical Review*, v. 104, ser. 2, Dec. 1, 1956, p. 1407-1410.

The γ-rays following the decay of Co^{56} and Co^{58} were observed by means of a large NaI(Tl) crystal scintillation spectrometer. Relative intensities of the Co^{56} γ radiation are presented as well as ratios of orbital electron capture to positron emission for both Co^{56} and Co^{58}.

4502 Angular Momentum Coupling and the Internucleon Interaction in the Calcium Isotopes. J. B. French and B. J. Raz. *Physical Review*, v. 104, ser. 2, Dec. 1, 1956, p. 1411-1423.

4503 Slow-Neutron Resonance Scattering in Ag, Au, and Ta. R. E. Wood. *Physical Review*, v. 104, ser. 2, Dec. 1, 1956, p. 1425-1433.

Slow-neutron resonance scattering measurements by the "bright-line" technique were used as a supplement to and a check on total cross section measurements.

4504 Study of the C^{14} (p,n) N^{14} and C^{14} (α,n) O^{17} Reactions. Richard M. Sanders. *Physical Review*, v. 104, ser. 2, Dec. 1, 1956, p. 1434-1440.

Targets of 38.7% C^{14} deposited from a glow discharge in acetylene, were used for the determination of threshold energies.

4505 Neutron Polarization in (p,n) Reactions and Nuclear Optical Model. J. Sawicki. *Physical Review*, v. 104, ser. 2, Dec. 1, 1956, p. 1441-1444.

The polarization of the neutron produced in a (p,n) reaction is calculated under the assumption of a direct mechanism for the reaction.

4506* (English.) **Observation of the High-Energy Proton-Proton Collision in Photographic Emulsion.** Shin-ichi Kaneko, Osamu Kusumoto, and Shigeo Matsumoto. *Physical Society of Japan, Journal*, v. 11, no. 11, Nov. 1956, p. 1129-1135.

The tracing-back method was applied to the detection of showers which could be regarded as those produced by single nucleon-nucleon collisions in a stack of stripped emulsions exposed to the stratosphere.

4507 The Momentum Spectrum of μ-Mesons at a Depth of 40 Metres Water Equivalent. W. F. Nash and A. J. Pointon. *Physical Society, Proceedings*, v. 69, no. 442A, Oct. 1956, p. 725-733.

Scattering distributions, obtained in two Pb plates, each 2 cm. thick, placed in a cloud chamber situated at a depth of 40 m. water equivalent, were used to determine the momentum spectrum.

4508 The Fermi, or Exchange, Hole in Atoms. V. W. Maslen. *Physical Society, Proceedings*, v. 69, no. 442A, Oct. 1956, p. 734-740.

The distribution, size, and shape of the exchange hole were studied for neon and A, using Slater wave functions. The results give further information concerning the nature of the hole.

4509 The Scattering of 130 MeV Neutrons by Protons. T. C. Randle, D. M. Skyrme, M. Snowden, A. E. Taylor, F. Uridge, and E. Wood. *Physical Society, Proceedings*, v. 69, no. 442A, Oct. 1956, p. 760-766.

Measurements in a diffusion cloud chamber.

4510 The Binding Energy of the Nitrogen Molecule. A. C. Hurley. *Physical Society, Proceedings*, v. 69, no. 442A, Oct. 1956, p. 767-776.

A recent self-consistent field mol. orbital calculation on the N mol. by Scherr is extended to include configuration interaction.

4511 The Quadrupole Polarizability of the Hydrogen Atom. C. A. Coulson and M. J. Stephen. *Physical Society, Proceedings*, v. 69, no. 442A, Oct. 1956, p. 777-782.

The quadrupole moment of a H atom in a general state induced by a uniform electric field was evaluated to second powers of the field strength.

4512 Nuclear Power Plant Heat Exchangers Are Different. S. Baron. *Power Engineering*, v. 60, Dec. 1956, p. 83-87.

Describes some of the ways in which the heat exchanger for the nuclear plant differs from the conventional heat exchanger; new problems the power engineer is going to meet in the use of this new form of power generation.

4513* (English.) **Nucleon Magnetic Moments in Ps-Ps Intermediate Coupling Meson Theory.** Akira Kanazawa and Masao Sugawara. *Progress of Theoretical Physics*, v. 16, Aug. 1956, p. 95-111.

4514* (English.) **On Quantum-Mechanical Nuclear Dipole Vibrations.** Jun-ichi Fujita. *Progress of Theoretical Physics*, v. 16, Aug. 1956, p. 112-130.

Proposes a modified collective model which accounts for the velocity-dependent character of neutron-proton exchange forces.

4515* (English.) **Energy Loss of a Charged Particle Traversing Ionized Gas and Injection Energies of Cosmic Rays.** Satio Hayakawa and Kazuo Kitao. *Progress of Theoretical Physics*, v. 16, Aug. 1956, p. 139-148.

4516* (English.) **Note on the Decay Interactions of Hyperons and Heavy Mesons.** Chikashi Iso and Masaaki Kawaguchi. *Progress of Theoretical Physics*, v. 16, Sept. 1956, p. 177-188.

Study is based on the Nishijima and Gell-Mann charge independence theory of heavy unstable particles.

4517* (English.) **On the Determination of the Spins of λ^0 and θ^0 Particles.** Shoichi Hori. *Progress of Theoretical Physics*, v. 16, Sept. 1956, p. 189-196.

4518* Fast Neutron Dosimetry at the Argonne National Laboratory Cyclotron. Richard B. Rhody. *Radiation Research*, v. 5, Nov. 1956, p. 495-501.

Dose rates as measured by tissue-equivalent chamber, proportional counter, chemical dosimeter, and threshold detector are in remarkably good agreement.

4519* A Calorimetric Determination of the Energy Required to Produce an Ion Pair in Air for Cobalt-60 Gamma-Rays. J. P. Bernier, L. D. Skarsgard, D. V. Cormack, and H. E. Johns. *Radiation Research*, v. 5, Dec. 1956, p. 613-633.

4520 Magnetic Recorder for Nuclear Pulses. P. E. Cavanagh and D. A. Boyce. *Review of Scientific Instruments*, v. 27, Dec. 1956, p. 1028-1033.

A simple reliable process for recording the amplitudes of individual pulses on magnetic tape. Low counting rates may be recorded with the tape moving slowly, and then speeded up on playback, thus reducing analyzer time.

4521 Nucleon Motion in a Rotating Potential. J. G. Valatin. *Royal Society, Proceedings*, v. 238, ser. A, Dec. 4, 1956, p. 132-141.

Motion is analyzed in terms of the orbits of the individual nucleons.

4522 Identification Curves for Heavy-Meson and Hyperon Decays. Howard S. White. *University of California Radiation Laboratory (U. S. Atomic Energy Commission)*, UCRL-3514, Sept. 1956, 26 p. (UF767 U3u Contin.)

4523* (German.) Nuclear Energy as Ship Propellant. **Kernenergie für Schiffsantriebe.** E. Ruprecht. *VDI Zeitschrift*, v. 98, no. 32, Nov. 1956, p. 1795-1796.

General outline for the project of utilizing nuclear energy in ships.

4524* (Russian.) Some Problems Concerning the Technique of Radiochemical Experiment. **Nekotorye voprosy tekhniki radiokhimicheskogo elementa.** A. A. Goriunov. *Zhurnal Analiticheskoi Khimii,* v. 11, no. 5, Sept.-Oct. 1956, p. 590-598.

A number of auxiliary devices for radiochemical experimental technique are described.

4525* (Russian.) A Calorimetric Determination of the Mean Energy of the β-Spectra of P^{32}, S^{35}, Cu^{64}, W^{185}, and Au^{198}. **Kalorimetricheskoe opredelenie srednikh energii β-spektrov P^{32}, S^{35}, Cu^{64}, W^{185}, i Au^{198}.** N. S. Shimanskaya. *Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki,* v. 31, no. 3, Sept. 1956, p. 393-396.

4526* (Russian.) Investigation of Two-Electron Capture in Collisions Between Positive Carbon or Oxygen Ions and Gas Molecules. **Izuchenie protsessov zakhvata dvukh elektronov pri stolknoveniiakh polozhitelnykh ionov ugleroda i kisloroda s molekulami gazov.** Ia. M. Fogel, R. V. Mitin, and A. G. Koval. *Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki,* v. 31, no. 3, Sept. 1956, p. 397-404.

Effective cross sections for these processes were measured for C^+ and O^+ ions.

4527* (Russian.) Fission of Uranium Nuclei Induced by High Energy Protons. **Delenie iader urana protonami vysokikh energii.** N. S. Ivanova and I. I. Pyanov. *Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki,* v. 31, no. 3, Sept. 1956, p. 416-423.

See also: **3379** (B_4C in nucleonics); **3383** (glasses insensitive to γ radiation); **3416** (preparation of heavy water); **3417** (batch or continuous processing in nuclear reactors); **3419** (reuse of cooling water in an AEC installation); **3493** (chemical aspects of nuclear reactors); **3756** (card-programmed reactor calculations); **3937** (atomic reactor economics); **4060** (benzene turbine cycle); **4640** (advances in nuclear physics); **4681** (coagulation of radioactive debris in water); **4682** (removal of radioactive fall-out); **4710** (ventilation of radioactive processes); **4785** (radiation safety procedures).

OPERATIONS RESEARCH AND MANAGEMENT ENGINEERING

4528 The Office: Its Changing Functions and Structure, With a Paper on Management as a Universal Language. *American Management Association, Office Management Series No.* 139, 1955, 44 p. (HD28 Am350 Vis.)

4529 Controlling Office Production. Methods—Machines—Systems. *American Management Association, Office Management Series No.* 140, 1955, 63 p. (HD28 Am350 Vis.)

Includes papers on clerical costs, work sampling, and integrated data processing and control.

4530 Controls and Techniques for Better Management. *American Management Association, General Management Series No.* 176, 1955, 64 p. (HD28 Am35g Vis.)

Various management tools and controls for growth, research, and development. Pitfalls of collective bargaining. Training for cost reduction. Personnel testing.

4531 Economics and Research Programming. B. H. Rosen and A. L. Regnier. *Chemical Engineering Progress,* v. 52, Dec. 1956, p. 500-502.

A method for rating research projects on the basis of such factors as probability of success and estimated economics if project is successful.

4532* Production Programming. R. E. McGarrah. *Journal of Industrial Engineering,* v. 7, Nov.-Dec. 1956, p. 263-271.

Incremental costs of changing production programs; determining the optimal production program.

4533* Job Design Research. Louis E. Davis and Ralph R. Canter. *Journal of Industrial Engineering,* v. 7, Nov.-Dec. 1956, p. 275-282.

Results of a study designed to test the effects of modifications in job content on productivity, quality, and job satisfaction.

4534* Use of Electronic Computers for Business Management. Herbert J. Groelinger. *Journal of Industrial Engineering,* v. 7, Nov.-Dec. 1956, p. 295-299.

Computer types; calculating procedures; type problems.

4535* Management Planning and Control—What Next? Paul Kircher. *Management Science,* v. 3, Oct. 1956, p. 1-8.

Pin-points the impact of automatic calculation on business techniques and probable future trends.

4536* Formalism, Realism, and Management Science. J. Sayer Minas. *Management Science,* v. 3, Oct. 1956, p. 9-14.

Use of models in solving business problems.

4537* On the Caterer Problem. William Prager. *Management Science,* v. 3, Oct. 1956, p. 15-23.

A paraphrase problem on the number of spare engines required to assure given operational levels of a fleet of airplanes.

4538* Solving the Transportation Problem. L. R. Ford, Jr. and D. R. Fulkerson. *Management Science,* v. 3, Oct. 1956, p. 24-32.

A step by step solution of an illustrative example based on Kuhn's combinatorial algorithm for the assignment problem.

4539* The Allocation of Aircraft to Routes—An Example of Linear Programming Under Uncertain Demand. Allen R. Ferguson and George B. Dantzig. *Management Science,* v. 3, Oct. 1956, p. 45-73.

Application to the problem of allocation in order to maximize expected profits.

4540* A Model for the Optimal Programming of Railway Freight Train Movements. A. Charnes and M. H. Miller. *Management Science,* v. 3, Oct. 1956, p. 74-92.

4541 The Essential Factors of Good Management. H. W. Prentis, Jr. *Mechanical Engineering,* v. 78, Dec. 1956, p. 1121-1124.

4542 Systematic Decision Making Robert Lillestrand. *Military Electronics,* v. 1, Dec. 1956, p. 16-19.

Breaking a complex problem down into its elements and reassembling the answers simplifies the process of making accurate decisions.

4543 Operations Research. A Basic Approach. 111 p. 1956. American Management Assn., New York, (HD28 Am35s Vis.)

Nine papers discuss operations research without excessive dependence on mathematical formulas, and show results obtained to date in a number of industries.

4544 Organizing for Effective Systems Planning and Control. 192 p. 1956. American Management Assn., New York. (HD28 Am35s Vis.)

A compilation of papers outlining development of systems planning, tools available for management's use, and their application in achieving company-wide integration.

4545 How Operations Research Aids the Refiner. Tage A. Mortensen. *Petroleum Refiner,* v. 35, Dec. 1956, p. 126 + 7 pages.

Use of operations research in business and industrial operations of refinery management.

4546 Proceedings, Automatic Data Processing Conference. Robert N. Anthony, editor. 194 p. 1956. Division of Research, Graduate School of Business Administration, Harvard University, Boston. (HF5548 H26a)

Papers establish a basis of communication and understanding between technical people and businessmen.

4547 The Theory of Games and Linear Programming. S. Vajda. 106 p. 1956. John Wiley & Sons, New York. (QA269 V21t)

See also: **3754** (linear programming applied to communication networks); **3938** (analysis of retailing sales); **4768** (management of research activities).

ORE AND MATERIALS BENEFICIATION

4548 Separation of Yttrium and Some Rare Earths by Liquid-Liquid Extraction. Raymond A. Foos and H. A. Wilhelm. *Ames Laboratory (U. S. Atomic Energy Commission)*, ISC-695, July 1954, 77 p. (UF767 Un3.1is Contin.)

Concentrates were obtained from Fergusonite ore, Gadolinite ore, and a by-product from an ion-exchange resin separation process, by extracting the HNO_3 solution with tributyl phosphate.

4549 Roasting to Remove Fluorides From Ammonium Diuranate. E. R. Johnson, E. O. Rutenkroger, H. M. Beers, and A. B. Kreuzmann. *Chemical Engineering Progress*, v. 52, Nov. 1956, p. 474-476.

4550 The Principle of "Convergence-Divergence" in Mixing and Other Applications. M. S. Frenkel. *Engineers' Digest*, v. 17, Nov. 1956, p. 475-480.

4551* Froth Flotation of Low-Rank Coal. I. The Adsorption of Phenol From Aqueous Solutions by Coals of Various Rank. G. F. Eveson, Stacey G. Ward, and F. Worthington. **II. Semi-Scale Investigation of Conditioning Methods.** J. A. Rogers, D. Simpson, and P. F. Whelan. *Institute of Fuel, Journal*, v. 29, Dec. 1956, p. 540-551.

Colorimetric techniques show that rate of adsorption of phenol decreases with increasing time and varies with the rank of coal. A high-speed multi-stage vertical-spindle conditioner was constructed, and tested with three coals.

4552 Sinter Plant Control. T. R. Zatkovich and B. E. Hamlett. *Instruments and Automation*, v. 29, Dec. 1956, p. 2419-2421.

Gravimetric blending of the sinter components is the most accurate technique. Permeability meters are now advocated for moisture control.

4553 Sintering Characteristics of a Cleveland Ironstone. P. K. Gledhill and C. Lang. *Iron and Steel Institute, Journal*, v. 184, Dec. 1956, p. 434-437.

Particular attention is given to the S content and state of oxidation in the finished sinter.

4554 Separation of Protactinium From Uranium Residues. Murrell L. Salutsky, Kenneth Shaver, Andrew Elmlinger, and Mary Lou Curtis. *Journal of Inorganic and Nuclear Chemistry*, v. 3, Nov. 1956, p. 289-295.

Method involves dissolution of the source material in dilute HCl, concentration of the Pa by precipitation of an internal silicate carrier, and final isolation of the Pa by anion exchange in strong HCl solutions.

4555 Precipitation of Uranium From Anaconda 27°Be Phosphoric Acid With Potassium or Calcium Hydroxides. Robert J. Woody and Galen W. Clevenger. *Massachusetts Institute of Technology (U. S. Atomic Energy Commission)*, MITG-218, Mar. 1950, 18 p. (UF767 U3mi Contin.)

Uranium precipitates more completely in a lower and narrower pH range by KOH neutralization than by other agents.

4556* The Concentration of Uranium From Low-Grade Ores. T. V. Arden. *Mine & Quarry Engineering*, v. 22, Dec. 1956, p. 498-506.

Description of various physical and chemical methods.

4557 The Mining and Dressing of Low-Grade Ores in Europe. 319 p. 1955. Organisation for European Economic Co-operation, Paris. (TN500 Or3m)

Reports of a mission examining the facilities available for research, and the practical results achieved, in the mining of low-grade ores in certain European countries. Includes details of plants and laboratories visited and a summary of symposia and discussions held during the tour.

4558 Non-Ferrous Ore Dressing in the U. S. A. 209 p. 1953. The Organisation for European Economic Co-operation, Paris. (TN500 Or14n)

Report of a European mission to the U. S., giving a general analytical description of ore-dressing technique and the flowsheet and essential characteristics of the main plants visited.

4559* Uranium Ores. Their Occurrence and Treatment. S. W. F. Patching. *Nuclear Power*, v. 2, Jan. 1957, p. 12-17.

Important minerals and ore types. Recovery procedures. World distribution and future supplies.

4560* (Polish.) The Feasibility of Economically Pressing Zinc Ore by the Gravitational Method Before Flotation. **Celowość wzbogacania grawitacyjnego rud cynkowych przed flotacja z punktu widzenia ekonomicznego.** Karol Czaplicki. *Rudy i Metale Niezelazne*, v. 1, no. 1, July-Sept. 1956, p. 19-22.

Poorer ores require consideration of the economics of washing and flotation of Zn-Pb ores. Discussion of the conditions under which the washing operation is not justified.

4561* (German.) Extraction of Alumina From Blast Furnace Slag for the Aluminium Industry. **Gewinnung von Tonerde aus Hochofenschlacke für die Aluminiumindustrie.** Otto Vorwerk, Paul Hüttemann, and Robert Mintrop. *Stahl und Eisen*, v. 76, no. 24, Nov. 29, 1956, p. 1628-1634.

4562 Recovery of Kyanite and Sillimanite From Florida Beach Sands. J. S. Browning, B. H. Clemmons, and T. L. McVay. *U. S. Bureau of Mines, Report of Investigations* 5274, Nov. 1956, 12 p. (TN21 Un3r)

Pilot-plant tests indicate that a combination of magnetic separation followed by flotation will yield a concentrate containing approximately 96% kyanite, sillimanite, and a minor quantity of corundum.

See also: **4022** (extraction of Al_2O_3 from bauxite).

PHYSICS

4563 Ultrasonic Relaxation in Freon Vapors. Y. Miyahara and E. G. Richardson. *Acoustical Society of America, Journal*, v. 28, Nov. 1956, p. 1016-1019.

4564 Performance of Ceramic Ferrite Resonators as Transducers and Filter Elements. Cornelis M. van der Burgt. *Acoustical Society of America, Journal*, v. 28, Nov. 1956, p. 1020-1032.

Literature review.

4565 Experiments With Vibrating Soap Membranes. L. Bergmann. *Acoustical Society of America, Journal*, v. 28, Nov. 1956, p. 1043-1047.

Studies of the natural oscillations of membranes by reflection of light from an acoustically excited soap film.

4566 Acoustic Filtering in a Moving Medium. Robert F. Lambert. *Acoustical Society of America, Journal*, v. 28, Nov. 1956, p. 1054-1058.

Formulations of one-dimensional sound propagation in a homogeneous, progressively moving medium are applied to calculations of recurrent filter characteristics of a side branch tube attached to the side wall of an air duct.

4567 Side Branch Insertion Loss in a Moving Medium. Robert F. Lambert. *Acoustical Society of America, Journal*, v. 28, Nov. 1956, p. 1059-1063.

Studies of the insertion loss of a side branch resonant filter in moving air reveal that nonlinear excitation of the resonator and turbulence may influence the measured characteristic.

4568 Reactive Components in Sound Absorber Construction. Carl Becker. *Acoustical Society of America, Journal*, v. 28, Nov. 1956, p. 1068-1071.

Basic criteria; design parameters.

4569 Electronic Binary Selection System for Phoneme Classification. Jacob Wiren and Harold L. Stubbs. *Acoustical Society of America, Journal*, v. 28, Nov. 1956, p. 1082-1091.

A successive-binary-selection system for automatic classification of sponken English into several groups of phonemes is described. The first step separates voiced from unvoiced by measuring the filtered output in the range of the pitch frequency.

4570 Vibrations in Long Rods of Barium Titanate With Electric Field Parallel to the Length. C. V. Stephenson. *Acoustical Society of America, Journal,* v. 28, Nov. 1956, p. 1192-1194.

Theoretical development.

4571 Physical Acoustics and the Properties of Solids. Warren P. Mason. *Acoustical Society of America, Journal,* v. 28, Nov. 1956, p. 1197-1206.

The techniques of physical acoustics were applied in determining the elastic properties and internal friction of polycrystal and single crystal metals, glasses, nonmetallic crystals, high polymer materials, and ceramics.

4572 Wave Propagation and the Measurement of the Elastic Properties of Liquids and Solids. H. J. McSkimin. *Acoustical Society of America, Journal,* v. 28, Nov. 1956, p. 1228-1232.

Diffraction effects as encountered in the measurement of acoustic attenuation at high frequencies are discussed with particular reference to low loss materials.

4573 Attenuation of Ultrasonic Waves of Finite Amplitude in Liquids. V. Narasimhan and R. T. Beyer. *Acoustical Society of America, Journal,* v. 28, Nov. 1956, p. 1233-1236.

Measurements in water and in aqueous solutions of acetic acid and manganous sulfate.

4574 On the Pressure Dependence of Sound Absorption in Liquids. Leonard Liebermann. *Acoustical Society of America, Journal,* v. 28, Nov. 1956, p. 1253-1255.

The theory of the dependence of sound absorption on pressure is given for liquids in which absorption significantly depends on the coefficients of bulk and shear viscosity. The bulk viscosity, and therefore sound absorption, is shown to be related to the equation of state.

4575* The Elastic Constants of Anisotropic Materials. II. R. F. S. Hearmon. *Advances in Physics,* v. 5, July 1956, p. 323-382 + 1 plate.

Review of work published since 1944.

4576 Thermodynamic Theory of Irreversible Processes. III. The Potentials of Electrochemical Cells in Gravitational and Centrifugal Fields. Donald G. Miller. *American Journal of Physics,* v. 24, Dec. 1956, p. 595-604.

Using the thermodynamic theory of irreversible processes, a general equation is derived for the solution potential of a multicomponent fluid containing both charged and uncharged species situated in a gravitational or centrifugal field.

4577 Interference in an Optical Wedge. Uri Oppenheim and Joseph H. Jaffe. *American Journal of Physics,* v. 24, Dec. 1956, p. 610-615.

A unified introductory treatment is presented both for two-beam and multiple-beam interference.

4578 Measurements on the Kerr Electro-Optical Effect. Myron A. Jeppesen. *American Journal of Physics,* v. 24, Dec. 1956, p. 623-625.

An experiment is described in which an inexpensive, commercially available cell is used. Values of the Kerr constant for nitrobenzene are determined.

4579 Dynamical Principle for Classical Mechanics. P. Stehle. *American Journal of Physics,* v. 24, Dec. 1956, p. 626-629.

The dynamical principle underlying nonrelativistic classical particle mechanics is stated in a way which brings it into exact analogy with the quantum principle. The classical equations of motion for a dynamical variable are then displayed in forms analogous to the Schrodinger, Heisenberg, and interaction forms in quantum theory.

4580 The Tensile Strengths of Viscous Liquids Under Dynamic Loading. T. H. Bull. *British Journal of Applied Physics,* v. 7, Nov. 1956, p. 416-418.

Under similar conditions of transient loading the cavitation of thresholds of syrup and olive oil are 130 X 10^6 dynes per sq. cm. and 29 X 10^6 dynes per sq. cm. respectively. For fluids with a viscosity (η) in the range 0.01 to 400 P the cavitation threshold pressure P_c is given by the empirical relation $P_c = K\eta^{0.3}$.

4581 Interaction Between Electrons and Lattice Vibrations. J. Bardeen. *Canadian Journal of Physics,* v. 34, Suppl. no. 12A, Dec. 1956, p. 1171-1189.

Calculation of electron-phonon interaction in metals; applications to electrical conductivity and importance of Umklapp processes; deformation potential methods; interaction with polar modes; the polaron problem.

4582 On the Statistical Mechanics of Irreversible Processes. I. Prigogine. *Canadian Journal of Physics,* v. 34, Suppl. no. 12A, Dec. 1956, p. 1236-1245.

4583 The General Variational Principle of Transport Theory. J. M. Ziman. *Canadian Journal of Physics,* v. 34, Suppl. no. 12A, Dec. 1956, p. 1256-1273.

Theoretical analysis of electron transport in solids.

4584 Nuclear Magnetic Resonance and Electronic Structure of Conductors. N. Bloembergen. *Canadian Journal of Physics,* v. 34, Suppl. no. 12A, Dec. 1956, p. 1299-1314.

The isotropic and anisotropic metallic shift, the relaxation time, isotropic and anisotropic spin exchange coupling, and quadrupole interactions. Variation of these effects as a function of pressure, temperature, and alloy composition.

4585 On the Magnitude of the Contribution of a Circulation Effect to the Thermal Conductivity of a Super-Conductor. C. J. Gorter. *Canadian Journal of Physics,* v. 34, Suppl. no. 12A, Dec. 1956, p. 1334-1335.

4586 Electron Interaction in Solids. David Pines. *Canadian Journal of Physics,* v. 34, Suppl. no. 12A, Dec. 1956, p. 1379-1394.

The formal treatment of electron-electron interaction in solids; influence of electron interaction on electron transport in metals.

4587 Our Knowledge of the Fermi Surface. R. G. Chambers. *Canadian Journal of Physics,* v. 34, Suppl. no. 12A, Dec. 1956, p. 1395-1423.

Available methods for studying shape of energy surfaces include magnetoresistance, cyclotron resonance, anomalous skin effect, and the de Haas-van Alphen effect.

4588* (English.) **Some Optical Properties of Zinc Sulfide Phosphors Doubly Activated With Copper and Manganese.** Shigeo Shionoya. *Chemical Society of Japan, Bulletin,* v. 29, no. 8, Nov. 1956, p. 935-944.

4589 Magnetic Data Recording Theory: Head Design. Albert S. Hoagland. *Communication and Electronics,* Nov. 1956, p. 506-512.

4590 Dynamax, a New Crystal and Domain-Oriented Magnetic Core Material. G. H. Howe. *Communication and Electronics,* Nov. 1956, p. 548-551.

High-permeability magnetic material containing approximately 65% Ni, 2% Mo, and 33% Fe has been developed in the form of thin tape for toroidal cores. Dynamic characteristics are superior to those of any rectangular hysteresis loop materials commercially available.

4591 Superposed Magnetic Fields in Materials With Rectangular Hysteresis Loops. C. B. Wakeman and F. J. Beck. *Communication and Electronics,* Nov. 1956, p. 562-569.

Characteristics of 50% Fe–50% Ni and 17% Fe–79% Ni–4% Mo alloys.

4592* (French.) Magnetic Properties of the Rare Earth Ferrites. $5Fe_2O_3.3M_2O_3$ With M=Tb, Dy, Ho, Er, Tm, Yb, Lu. Experimental Results. **Propriétés magnétiques des ferrites de terres rares $5Fe_2O_3.3M_2O_3$ avec M=Tb, Dy, Ho, Er, Tm, Yb, Lu. Résultats expérimentaux.** René Pauthenet. *Comptes Rendus,* v. 243, no. 2, Nov. 12, 1956, p. 1499-1502.

A study of the thermal variation of spontaneous magnetization and paramagnetic susceptibility above the Curie point of some rare earth ferrites of the garnet type.

4593* (French.) A New System of Emission Bands of the He_2 Molecule Towards 4700 $cm.^{-1}$. **Nouveau système de bandes d'émission de la molécule He_2 vers 4700cm^{-1}.** Georges Hepner and Louis Herman. *Comptes Rendus,* v. 243, no. 2, Nov. 12, 1956, p. 1504-1506.

4594 Voltage Dependence of Electroluminescence of Powdered Phosphors. Willi Lehmann. *Electrochemical Society, Journal*, v. 103, Dec. 1956, p. 667-672.

The time-average electroluminescent emission intensity of powdered phosphors was measured over wide ranges of the applied sinusoidal voltage.

4595 (German.) Four-Dimensional Space. **Der Vierdimensionale Raum.** Roland W. Weitzenböck. 223 p. 1956. Birkhäuser Verlag, Stuttgart. (QA691 W43v)

Discusses the concept of the fourth dimension (time) as discussed by different authors from mathematicians to fantasy novelists.

4596 Ultrasonic Attenuation Caused by Thermoelastic Heat Flow. Kurt Lücke. *Journal of Applied Physics*, v. 27, Dec. 1956, p. 1433-1438.

Expressions for the attenuation of sound waves in a standard linear viscoelastic body were derived and applied to the attenuation due to the thermoelastic effect.

4597 Magnetic Granulometry and Super-Paramagnetism. C. P. Bean and I. S. Jacobs. *Journal of Applied Physics*, v. 27, Dec. 1956, p. 1448-1452.

The magnetic method of particle size measurement is evaluated.

4598 Asymptotic Expansions of Solutions of the Heat Conduction Equation in Internally Bounded Cylindrical Geometry. R. H. Ritchie and A. Y. Sakakura. *Journal of Applied Physics*, v. 27, Dec. 1956, p. 1453-1459.

Results are applied to the case of the internally bounded infinite cylindrical medium with the boundary held at constant temperature; with constant heat flow over the boundary; and with the "radiation" boundary condition.

4599 Simple Modes of Vibration of Crystals. R. D. Mindlin. *Journal of Applied Physics*, v. 27, Dec. 1956, p. 1462-1466.

Solutions of the three-dimensional equations of elasticity and the equations of generalized plane stress pertaining to vibrations of crystal rectangular parallelepipeds and thin plates with traction-free faces.

4600 Theory of Rotational - Vibrational Interaction in Polyatomic Molecules. Lewis J. Bodi and C. F. Curtiss. *Journal of Chemical Physics*, v. 25, Dec. 1956, p. 1117-1122.

4601* Luminescence in ZnS:Cu,Cl Single Crystals. T. B. Tomlinson. *Journal of Electronics*, v. 2, ser. 1, Nov. 1956, p. 293-300.

The impurity responsible for the green and blue bands in "spectrographically pure" single crystals of ZnS is proved to be Cu, in conjunction with Cl.

4602 The Influence of an External Electric Field on the Optical Activity of Fluids. Ignacio Tinoco, Jr. and William G. Hammerle. *Journal of Physical Chemistry*, v. 60, Dec. 1956, p. 1619-1623.

Change in activity is due to the partial orientation of the constituent molecules by the field.

4603 Eight-Channel Recording on ¼ in. Magnetic Tape With a Stationary-Tape Playback. J. C. Barton. *Journal of Scientific Instruments*, v. 33, Nov. 1956, p. 415-419.

Construction and performance of multi-channel magnetic heads; interference between channels and playback circuits.

4604 Light and Sound. M. Nelkon. 2nd Ed. 364 p. 1956. William Heinemann, London. (QC355 N32L2)

Fundamental optical principles of mirrors, prisms, lenses, dispersion, optical instruments, photometry, and velocity of light measurement. Interference, diffraction, and polarization. Characteristics, properties, and velocity of sound waves. Vibrations in pipes, strings, and rods.

4605 Optical Properties of Zinc Sulfide and Cadmium Sulfide in the Ultraviolet. Joseph F. Hall, Jr. *Optical Society of America, Journal*, v. 46, Dec. 1956, p. 1013-1015.

Index of refraction and the extinction coefficient of thin films evaporated on quartz substrates were determined.

4606 Contact Potential Difference Between Sensitizing Dye and Substrate. R. C. Nelson. *Optical Society of America, Journal*, v. 46, Dec. 1956, p. 1016-1019.

Potential between CdS and the dyes pinacyanole, kryptocyanine, and neocyanine and between AgBr and pinacyanole was measured by the electron beam retardation method.

4607 Semisolid Nickel Sulfate Filter. Louis A. Strait, Frank M. Goyan, and W. D. Kumler. *Optical Society of America, Journal*, v. 46, Dec. 1956, p. 1038-1042.

Preparation and properties of a semisolid Ni sulfate-sorbital complex with excellent aging characteristics. Complex is useful in ultra-violet spectroscopy.

4608 Excitation Mechanism of Arc Spectra Lines From a Study of Cadmium Arc Spectra. A. K. Dutta and U. Gantayet. *Optical Society of America, Journal*, v. 46, Dec. 1956, p. 1046-1048.

4609 Chromatic Significance of Spectrophotometric Errors. Thorne Shipley and Gordon L. Walker. *Optical Society of America, Journal*, v. 46, Dec. 1956, p. 1052-1060.

Analytic expressions are developed for describing the relationship between the maximum instrument error in the spectrophotometric measurement of colored samples and the corresponding maximum displacement of the CIE chromaticity coordinates.

4610 Slit Function Effects in the Direct Measurement of Absorption Line Half-Widths and Intensities. Henry J. Kostkowski and Arnold M. Bass. *Optical Society of America, Journal*, v. 46, Dec. 1956, p. 1060-1064.

Considers the distortion of spectral lines by the finite band pass of spectrometers.

4611 Magnetic Resonance and Minimum Entropy Production. Macroscopic Equations of Motion. Roald K. Wangsness. *Physical Review*, v. 104, ser. 2, Nov. 15, 1956, p. 857-866.

A generalization and modification of a previous discussion which enables one to test the adequacy of the form of equations proposed to describe relaxation phenamena in resonance by finding whether they satisfy this condition.

4612 Magnetic Quenching of 3-Photon Annihilation in Solids. V. L. Telegdi, J. C. Sens, D. D. Yovanovitch, and S. D. Warshaw. *Physical Review*, v. 104, ser. 2, Nov. 15, 1956, p. 867-873.

The above occurs in Teflon and fused quartz, while the rate in Al is unaffected.

4613 Tensile Strength of Liquid Helium II. J. W. Beams. *Physical Review*, v. 104, ser. 2, Nov. 15, 1956, p. 880-882.

Values measured by spinning capillary method and by a piston and cylinder method were smaller than expected.

4614 Specific Heat of the Superconducting State. G. V. Chester. *Physical Review*, v. 104, ser. 2, Nov. 15, 1956, p. 883-885.

Shows that, for Sn, the lattice specific heat of the normal state is also present in the superconducting state.

4615 Resonance and Reversal Phenomena in Ferromagnetic Films. R. L. Conger and F. C. Essig. *Physical Review*, v. 104, ser. 2, Nov. 15, 1956, p. 915-923.

Experiments on evaporated films of three different alloy compositions demonstrate a predicted proportionality of the reversal time and the resonance line width.

4616 Magnetic Structures of the Polymorphic Forms of Manganous Sulfide. Lester Corliss, Norman Elliott, and Julius Hastings. *Physical Review*, v. 104, ser. 2, Nov. 15, 1956, p. 924-928.

Two cubic modifications and a hexagonal third form are discussed.

4617 Magnetic Susceptibility of NiO and CoO Single Crystals. J. R. Singer. *Physical Review*, v. 104, ser. 2, Nov. 15, 1956, p. 929-932.

Temperature relationships are established.

4618 Validity of the Assumption of Two-Body Interactions in Molecular Physics. Laurens Jansen and Rosemary T. McGinnies. *Physical Review*, v. 104, ser. 2, Nov. 15, 1956, p. 961-966.

4619 Deformation Energy of a Charged Drop. II. Symmetric Saddle Point Shapes. W. J. Swiatecki. *Physical Review*, v. 104, ser. 2, Nov. 15, 1956, p. 993-1005.

A theoretical development.

4620 Function Spaces in Quantum-Mechanical Theory. E. L. Hill. *Physical Review*, v. 104, ser. 2, Nov. 15, 1956, p. 1173-1178.

A study of inner-product function spaces which can be defined on the basis of the asymptotic behavior of various classes of functions.

4621 Solid State Luminescence Theory and Oscillator Strengths in KCl:Tl. R. S. Knox and D. L. Dexter. *Physical Review*, v. 104, ser. 2, Dec. 1, 1956, p. 1245-1252.

Prediction of the oscillator strengths of the 1960 and 2475 A absorption lines.

4622 Halogen Band in Sodium Chloride. Russell C. Casella. *Physical Review*, v. 104, ser. 2, Dec. 1, 1956, p. 1260-1263.

The approximation of tight binding is employed to determine a minimum for the width of the halogen band in NaCl.

4623 Critical Points and Lattice Vibration Spectra. James C. Phillips. *Physical Review*, v. 104, ser. 2, Dec. 1, 1956, p. 1263-1277.

A method for obtaining directly from group-theoretical and topological considerations a consistent set of critical points belonging to a given secular equation. A detailed discussion of nonanalytic behavior near degeneracies.

4624 Scattering of Electrons by Lattice Vibrations in Nonpolar Crystals. Walter A. Harrison. *Physical Review*, v. 104, ser. 2, Dec. 1, 1956, p. 1281-1290.

A theoretical analysis of the scattering of electrons by lattice vibrations in nonpolar crystals is made which permits an estimate of the relative importance of acoustical-mode and optical-mode scattering in monatomic nonmetals. This comparison is achieved by expanding the matrix elements for scattering in powers of the electron wave number.

4625 Dependence of the Pure Quadrupole Resonance Frequency on Pressure and Temperature. T. Kushida, G. B. Benedek, and N. Bloembergen. *Physical Review*, v. 104, ser. 2, Dec. 1, 1956, p. 1364-1377.

Measurements of the pure quadrupole resonance frequency (ν) of the Cu^{63} nucleus in cuprous oxide, and the Cl^{35} nucleus in potassium chlorate and paradichlorofenzene were made as a function of pressure in the range 1 to 10,000 kg. per sq. cm. for temperatures between −77 and 100 C.

4626* (English.) **Crystal Structure of Ferromagnetic Nickel Oxide.** Yasumitsu Shimomura, Morio Kojima, and Shozo Saito. *Physical Society of Japan, Journal*, v. 11, no. 11, Nov. 1956, p. 1136-1146.

Determination of crystal structure by the flame fusion method.

4627* (English.) **Radiative Collisions Between Electronic and Molecular Beams. I. Angular Momentum Distribution Among OH Radicals Resulting From H_2O Molecules.** Tadao Horie, Takayuki Nagura, and Masamoto Otsuka. *Physical Society of Japan, Journal*, v. 11, no. 11, Nov. 1956, p. 1157-1170.

4628 Measurements of the Velocity and Absorption of High-Frequency Ultrasonic Waves in Supercooled Liquids. A. N. Hunter. *Physical Society, Proceedings*, v. 69, no. 442B, Oct. 1956, p. 965-974.

Discontinuities occur in the gradient of the velocity-temperature relation similar to those in the case of viscosity and dielectric constant.

4629 The Anisotropy Correction in Ferromagnetic Resonance. K. J. Standley and K. W. H. Stevens. *Physical Society, Proceedings*, v. 69, no. 442B, Oct. 1956, p. 993-996.

A method is described for finding the net absorption, at a given magnetic field, resulting from the superposition of absorption lines from the randomly distributed crystallites of a polycrystalline material.

4630 The Magnetic Susceptibilities of Two Polymorphic Forms of Manganese Sulphide. W. S. Carter and K. W. H. Stevens. *Physical Society, Proceedings*, v. 69, no. 442B, Oct. 1956, p. 1006-1012.

Measurements on a Zn blende type and a wurtzite type.

4631 Supersonic Dislocations and Dislocations in Dispersive Media. J. D. Eshelby. *Physical Society, Proceedings*, v. 69, no. 442B, Oct. 1956, p. 1013-1019.

The conditions governing the motion of a screw dislocation at velocities above and below the velocity of shear waves are contrasted.

4632 The Freezing of Water Droplets. A. E. Carte. *Physical Society, Proceedings*, v. 69, no. 442B, Oct. 1956, p. 1028-1037.

A microscope method was used to study the freezing of individual water droplets 9 to 33 μ in diameter formed by condensation on various surfaces and protected with a film of silicone oil.

4633 Compression of Solidified Gases to 20,000 kg/cm² at Low Temperature. John W. Stewart. *Physics and Chemistry of Solids*, v. 1, Nov. 1956, p. 146-158.

The relative volume decrease as a function of pressure was measured for solid He, H_2, D_2, and Ne at 4 K, for N_2 and argon at 65 K, and for argon at 77 K by the direct piston displacement method.

4634 Paramagnetic Resonance and Polarization of Nuclei in Metals. I. M. Lifshitz, M. Ya. Azbel, and V. I. Gerasimenko. *Physics and Chemistry of Solids*, v. 1, Nov. 1956, p. 164-174.

Theory of paramagnetic resonance in metals is based on a simultaneous solution of Maxwell's equations and of the kinetic equation for the density operator. In paramagnetic resonance there is a selective transparency of metallic films, and the transmitted wave is circularly polarized, if the constant magnetic field is normal to the surface.

4635 Ceramic Magnets. Richard A. Scholten. *Product Engineering*, v. 27, Dec. 1956, p. 143-148.

How Ba ferrite magnets compare with Alnicos; how to utilize the high coercive force and potential energy of ceramic magnets; holding, driving, and generator applications.

4636* (English.) **On the Quantum Mechanics-Like Description of the Theories of the Brownian Motion and Quantum Statistical Mechanics.** Nobuhiko Saitô and Mikio Namiki. *Progress of Theoretical Physics*, v. 16, Aug. 1956, p. 71-94.

Mathematical analysis.

4637* (English.) **On the Quantum Field Theory of the Interaction Between the Gravition and the Matter Field.** Toshiei Kimura. *Progress of Theoretical Physics*, v. 16, Sept. 1956, p. 157-176.

4638* (English.) **Partial Description of Quantum-Mechanical System.** Gentaro Araki. *Progress of Theoretical Physics*, v. 16, Sept. 1956, p. 197-211.

The quantum-mechanical system is divided into several interacting parts.

4639 Quantum Field Theory. H. Umezawa. 364 p. 1956. North-Holland Publishing Co., Amsterdam. (QC174.1 Um2q)

Comprehensive treatise on relativistic field equations, their quantization, renormalization theory, scattering problems, methods of calculations, and various specialized problems of known particles and their interactions.

4640 Recent Advances in Science, Physics and Applied Mathematics. Morris H. Shamos and George M. Murphy, editors. 384 p. 1956. New York University Press, New York. (QC21 Sh17r)

A symposium of 12 papers presented by experts for reading by non-experts. Succinctly covers applied mathematics, operations research, atomic and nuclear structures and machines, solid state studies, and cryogenics.

4641 Effect of an Axial Cavity on the Temperature History of a Surface Heated Slab. Joseph I. Masters and Seymour Stein. *Review of Scientific Instruments*, v. 27, Dec. 1956, p. 1065-1069.

Theoretical study of the surface temperature of a front heated slab in the presence of small holes drilled to within a fraction of a centimeter of the heated surface.

4642 Thermal Conductivities of Liquids: New Determinations for Seven Liquids and Appraisal of Existing Values. A. R. Challoner and R. W. Powell. *Royal Society, Proceedings*, v. 238, ser. A, Dec. 4, 1956, p. 90-106.

A guarded hot-plate apparatus is used for absolute determinations of the thermal conductivities of water, heavy water, glycerine, ethyl alcohol, toluene, medicinal paraffin, and CCl_4.

4643* **Magnetic 16mm Single-System Sound-on-Film Recording Camera Equipment.** Walter Bach, E. M. Berndt, A. N. Brown, and R. L. George. *Society of Motion Picture and Television Engineers, Journal*, v. 65, Nov. 1956, p. 603-605.

4644 (German.) Tables of Electron Physics, Ion Physics, and Ultramicroscopy. **Tabellen der Elektronenphysik Ionenphysik und Übermikroskopie.** Manfred von Ardenne. v. I. 614 p. 1956. VEB Deutscher Verlag der Wissenschaften, Berlin. (TK7855 Ar28t Over.)

Tables of important formulas, elementary processes, technical-physical data, and properties of materials. Includes high vacuum engineering, thermodynamics, optics, stress, magnetism, nuclear physics, and mathematical data.

4645* (German.) The Influence of Charge Carrier Injection on Electroluminescence in the Alternating Field. **Der Einfluss der Ladungsträgerinjektion auf die Wechselfeldelek troluminieszenz.** Dietrich Hahn and F. W. Seemann. *Zeitschrift für Physik*, v. 146, no. 5, Nov. 1956, p. 644-654.

Shows how the asymmetry of the luminescent wave comes from the action of a luminescent layer during the alternating field stimulation, i. e. surface effects at the point of contact of electrodes. Explains the clearer flash of light noticed at the anode and the cathode according to the test conditions and in relation to the movement of the charge carrier.

See also: **3384** (iron oxide magnets); **3755** (atomic spectra); **3820** (speech analysis-synthesis scheme); **3860** (quenching of luminescence); **3948** (acoustic streaming in liquids); **4035** (astronomical optics); **4062** (phonetic typewriter); **4461** (radiation damage in quartz).

PLASTICS

4646 Disulfide Polymers of DL-α-Lipoic Acid. Richard C. Thomas and Lester J. Reed. *American Chemical Society, Journal*, v. 78, Dec. 5, 1956, p. 6148-6149.

Evidence for a linear disulfide structure of polymeric material produced when DL-α-lipoic acid is heated.

4647* (English.) **Action of Emulsifier Upon the Copolymerization of Acrylonitrile and Styrene.** Moriya Uchida and Hideo Nagao. *Chemical Society of Japan, Bulletin*, v. 29, no. 8, Nov. 1956, p. 928-935.

The composition of copolymer depends upon the concentration of emulsifier; system becomes thick with less acrylonitrile.

4648* **Phosphonic Polymers. I. The Copolymerisation of Diethyl Vinylphosphonate and Styrene.** C. L. Arcus and R. J. S. Matthews. *Chemical Society, Journal*, Nov. 1956, p. 4607-4612.

4649* (Russian.) Chemistry of Active Molecules Forming During Mechanical Destruction of Polymers. **O khimii aktivnykh molekul, obrazuiushchikhsia pri mekhanicheskoi destruktsii polimerov.** *Doklady Akademii Nauk SSSR*, v. 110, no. 3, Sept. 21, 1956, p. 401-403.

Effects of temperature, friction, cavitation, ultrasonic waves, and rate of flow on polystyrene, rubber, polyvinylacetate, cellulose, starch, albumen, and other high polymers.

4650 Welded Polyethylene Duct Systems Resist Corrosion, Cut Costs. J. A. Neumann and F. J. Bockhoff. *Heating, Piping & Air Conditioning*, v. 29, Jan. 1957, p. 171-173.

Structural grade polyethylene ducts are fabricated by hot gas welding into ventilation systems for severely corrosive service. Polyethylene is also used for tanks, fume scrubbers, and other equipment; it is light in weight, highly flexible, and possesses high impact strength.

4651 Poly-Alpha-Methylstyrene. G. D. Jones, R. E. Friedrich, T. E. Werkema, and R. L. Zimmerman. *Industrial and Engineering Chemistry*, v. 48, Dec. 1956, p. 2123-2131.

Preparation and properties. If its mol. wt. is minimal, it has good heat resistance, solvent resistance, and hardness.

4652 Ionic Derivatives of Polyacrylamide. A. M. Schiller and T. J. Suen. *Industrial and Engineering Chemistry*, v. 48, Dec. 1956, p. 2132-2137.

Preparation and properties.

4653* (Swedish.) The Use of Ionizing Radiation in High Polymer Chemistry. **Användning av joniserande stroålning inom högpolymerkemi.** Per-Olof Kinell. *IVA Tidskrift för Teknisk-Vetenskaplig Forskning*, v. 27, no. 6, 1956, p. 233-255.

Influence on polymerization of radiation dose, radiation intensity, and added organic liquids. Relation between chemical structure and radiation effects. Radiation sources and some economic aspects.

4654 The Curing Mechanism of Epoxy Resins. W. Fisch, W. Hofmann, and J. Koskikallio. *Journal of Applied Chemistry*, v. 6, Oct. 1956, p. 429-441.

Study of curing resins from 2:2-bis-(4-hydroxyphenyl) propane with phthalic anhydride shows that in all cases an equilibrium is set up in which, after complete reaction of the epoxy groups, there are present anhydride, monoester, and hydroxyl groups.

4655 Vapor Pressure of Plastic Materials. Niels Jensen. *Journal of Applied Physics*, v. 27, Dec. 1956, p. 1460-1462.

A method of measuring equivalent N vapor pressure of polymeric materials over a range of temperatures. Includes values for nylon, Teflon, saran, polyethylene, and mylar.

4656 The Light Scattering Behavior of Three Dimensional Network Gels. Joseph Yudelson and Bernard Rabinovitch. *Journal of Physical Chemistry*, v. 60, Nov. 1956, p. 1512-1518.

The polyglyceryl sebacate and polyglyceryl hexahydrophthalate systems, though as rigid as polymer in bulk, behave in the light scattering sense as simple liquids.

4657 Dynamometer for Tensile Testing of High Polymers. A. R. Payne and J. F. Smith. *Journal of Scientific Instruments*, v. 33, Nov. 1956, p. 432-435.

New dynamometer head comprises a proof ring and an induction displacement pick-up attached to a conventional tensile tester. It can be fitted to all standard testing machines by simple adaptors.

4658 "Zytel" Nylon Resin—A Versatile Engineering Material. W. C. Warriner and A. J. Cheney. *Mechanical Engineering*, v. 78, Dec. 1956, p. 1118-1120.

Industrial applications of Zytel nylon massive fabrications.

4659 The Molten Bead Sealer. H. G. Chinn. *Modern Packaging*, v. 30, Dec. 1956, p. 153-156, 214.

Development of a new high-speed method of sealing polyethylene film and laminates, with considerations and indications for its use in the packaging field.

4660* **Thermal Polymerisation of Ethylene. Studies at High Pressures.** S. K. Bhattacharyya and M. Shamaiengar. *Petroleum*, v. 19, Dec. 1956, p. 435-438.

An investigation of polymerization at temperatures between 295 and 410 C. in the pressure range 2,400 to 7,400 psi.

4661* (Dutch.) Plastics Applied to Agriculture and Horticulture. **Kunststoffen worden toegepast in de land-en tuinbouw.** J. O. W. Dugteren. *Plastica*, v. 9, no. 11, Nov. 1956, p. 668-671.

A comparison between glass and polyester plastic protection in horticulture; practical applications.

4662* **Effect of Long-Term Loading on Glass Fiber-Reinforced Plastic Laminates.** K. H. Boller. *Plastics Technology*, v. 2, Dec. 1956, p. 808-818, 820-821.

One epoxy and two polyester resin laminates are being tested in tension, flexure, and shear at 73 F and 50% relative humidity, and while immersed in water at 73 F, for periods up to 5 yrs. Data from the first 10,000 hrs. indicate that stress at rupture decreases with time, the rate of decrease being greater in water than in air. The tensile creep behavior may be expressed by the relationship $\epsilon = \epsilon_0 (1 + tn)$ where ϵ is the total strain in inches per inch of a material under constant stress; ϵ_0 is initial strain; t is time in hrs. and n is a dimensionless exponent.

4663 Polymer Solutions. H. Tompa. 325 p. 1956. Academic Press, New York. (QD281.P6 T59p)

Deals with those properties from which information can be derived on the structure of the polymer molecule in solution, on its size, both as regards weight and extension in space, and on its shape.

4664 Isotactic Polymers, Potential New Fibres. J. W. S. Hearle. *Research*, v. 9, Dec. 1956, p. 461-465.

The side-groups of isotactic polymers spiral regularly around the main chain so that the molecules are closely packed, with strong attractive forces between them. In general, such polymers are harder, stronger, less flexible, less affected by heat, and more resistant to solvents than ordinary random polymers. The regular structure, permitting crystallization, shows particular promise for the textile industry. Isotactic polypropylene, polybutylene, polypentene, and polystyrene have been synthesized by combining individual molecular units in the particular spatial configurations necessary to produce the spiral arrangement. Raw materials are cheap and easily available. Isotactic propylene fibers are stronger, more extensible, and tougher than nylon. Further developments in control of geometrical configuration may result in raising the melting point, introducing moisture absorption, making the material easier to dye, lowering electrical resistance, and further variation of properties.

4665 Observations on Intramolecular Reaction in Addition Polymerization Systems. T. Holt and W. Simpson. *Royal Society, Proceedings*, v. 238, ser. A, Dec. 18, 1956, p. 154-174.

Studies of 14 diallyl esters support the theory that tendency of a monomer to cyclize is largely controlled by distance between polymerizable groups.

4666* Epoxy-Butadiene Resins. C. G. Fitzgerald, A. J. Carr, M. Maienthal, and P. J. Franklin. *SPE Journal*, v. 13, Jan. 1957, p. 22-24, 58.

Some experimental epoxidations and isolations of polybutadiene; curing of the product; electrical properties.

4667* Thermoplastic Pipe. B. Kellam. *SPE Journal*, v. 13, Jan. 1957, p. 31-34.

Factors involved in the use of plastic pipe by an electrical utility; environmental test results; examples of pipe applications.

4668 Synthetic Polypeptides. Preparation, Structure, and Properties. C. H. Bamford, A. Elliott, and W. E. Hanby. 445 p. 1956. Academic Press, New York. (QD431 B21s)

Includes chain configurations, infra-red spectra, X-ray diffraction studies, and relation to fibrous proteins.

4669* (German.) Polysilane. **Über Polysilane. I.** Preparation of Polysilane(1). **Ein Verfahren zur Darstellung von Polysilan(1).** G. Schott and W. Herrmann. **II.** Properties and Structure of Polysilane(1). **Eigenschaften und Struktur von Polysilan(1).** G. Schott and E. Hirschmann. *Zeitschrift für Anorganische und Allgemeine Chemie*, v. 288, nos. 1-2, Nov. 1956, p. 1-14.

Reaction of tribromosilane with Mg in an ether solution results in formation of (SiH)n. Structure and properties.

4670* (Russian.) Research on the Copolymerization of Styrene and Butyl Methacrylate and on the Spatial Transformation of the Copolymers Obtained. **Issledovanie v oblasti sopolimerizatsii stirola i butilmetakrilata i prevrashcheniia polu-chennykh sopolimerov v trekhmernoe sostoianie.** A. Ia. Drinberg and G. A. Nosaev. *Zhurnal Prikladnoi Khimii*, v. 29, no. 11, Nov. 1956, p. 1730-1740.

The oxidation processes taking place during the transforming of the copolymers of styrene and butyl methacrylate into three-dimensional copolymers is very important.

See also: **3543** (polyene aldehydes); **3713** (resin adhesives); **4753** (polymeric adhesives).

POLLUTION AND WASTES

4671 Removal of Air-Borne Particulates and Allergens by a Portable Electrostatic Precipitator. Leslie Silverman and Richard Dennis. *Air Conditioning, Heating, and Ventilating*, v. 53, Dec. 1956, p. 75-80.

Results of extensive tests to determine the collection efficiency of a portable electrostatic filter for various airborne contaminants. Tests were made at two air flow rates.

4672* (German.) Brief Dust-Engineering Monograph on Properties and Behavior of Iron-Oxide Aerosols. **Kurze staubtechnische Monographie über Eigenschaften und Verhalten von Eisenoxyd-Aerosolen.** R. Meldau. *Archiv für das Eisenhüttenwesen*, v. 27, no. 11, Nov. 1956, p. 673-679.

Hematite, martite, and magnetite aerosol formation conditions and their precipitation with water or steam.

4673 British Types of Dust Collection Equipment. Alan Wilson. *Fuel Efficiency*, v. 4, Nov. 1956, p. 782-786.

Description and operation. (To be continued.)

4674* (German.) Aerosol Filtration With Membrane Filters. **Aerosofiltration mit Hilfe von Membranfiltern.** K. H. Maier. *Grenzflächenprobleme und Reaktionen im kolloiden Zustand*, Suppl. no. 17; *Kolloid-Zeitschrift*, v. 146, 1956, p. 151-156. (QD549 En19g)

Study of a process for the collection and evaluation of dust samples. Green membrane filters and light from a vertical source were used. The original grain size and composition were not changed. Some dust specimens could be almost microscopic in size and still be safely separated.

4675 Recovery of Cyanide From Waste Cyanide Solutions by Ion Exchange. Eric Goldblatt. *Industrial and Engineering Chemistry*, v. 48, Dec. 1956, p. 2107-2114.

Use of a strong-base ion exchange resin. Recovery is promising enough to warrant additional work on a pilot plant scale.

4676 Adaptation of Treated Sewage for Industrial Use. Sheppard T. Powell. *Industrial and Engineering Chemistry*, v. 48, Dec. 1956, p. 2168-2171.

Treatment procedures. Examples of successful installations.

4677 Fibrous Filters for Air Sterilization Design Procedure. Elmer L. Gaden, Jr. and Arthur E. Humphrey. *Industrial and Engineering Chemistry*, v. 48, Dec. 1956, p. 2172-2176.

Proper design of sterilizing filters makes possible considerable reduction in size, accompanied by greater reliability.

4678 Fibrous Filters for Air Sterilization, Experimental Studies With a Pilot Scale Filter. William D. Maxon and Elmer L. Gaden, Jr. *Industrial and Engineering Chemistry*, v. 48, Dec. 1956, p. 2177-2179.

Pilot plant tests show good correlation with laboratory data for a fibrous filter supplying air for fermentation processes.

4679 Role of Turbine Impellers in Aeration of Activated Sludge. J. Y. Oldshue. *Industrial and Engineering Chemistry*, v. 48, Dec. 1956, p. 2194-2198.

Measurement of effects of rate of gas flow, rate of O uptake, and dissolved O level; determination of the most effective combination of air flow, mixer horsepower, and the most effective tank shape.

4680 Instrumentation for Air Pollution. Robert J. Byran and J. C. Romanovsky. *Instruments and Automation*, v. 29, Dec. 1956, p. 2432-2438.

The Los Angeles air monitoring program. Principles, calibration, and operation of monitoring and recording instruments for SO_2, oxidants, CO, NO, NO_2, particulates, and ozone.

4681 A Study of the Removal of Radioactive Particulate Matter From Water by Coagulation. Nathan C. Burbank, Jr., Robert A. Lauderdale, and Rolf Eliassen. *Massachusetts Institute of Technology (U. S. Atomic Energy Commission)*, NYO-4440, Sept. 1955, 108 p. (UF767 U3ny Contin.)

Primary objective was to determine the effectiveness of the common methods of coagulation and the fundamental mechanism of the process.

4682 The Removal of Radioactive Fall-Out From Water by Municipal and Industrial Water Treatment Plants. Robert A. Lauderdale and Rolf Eliassen. *Massachusetts Institute of Technology (U. S. Atomic Energy Commission)*, NYO-4441, Mar. 1956, 79 p. (UF767 U3ny Contin.)

Removals obtained are subject to extreme variation but the average removal was from 50 to 75%.

4683* New Recording Turbidimeter for Measuring Water Turbidity and Low Consistency Slurries in the Paper Industy. E. H. Beazley and W. Mikelson. *Pulp and Paper Magazine of Canada*, v. 57, Nov. 1956, p. 165-168.

4684* Odour Abatement in an Alkaline Pulp Mill. C. L. Tomlinson and J. M. Ferguson. *Pulp and Paper Magazine of Canada*, v. 57, Dec. 1956, p. 119-122.

Principal measures employed are condensation and cooling of the blow and relief steam in a two-stage system. Correct proportioning of the alkali used for cooking is important.

4685* Chemical Recovery From Sulphite Waste Liquor by Pyrolysis. III. The Atomized Suspension Technique. W. Rabinovitch, P. Luner, R. H. W. James, and W. H. Gauvin. *Pulp and Paper Magazine of Canada*, v. 57, Dec. 1956, p. 123-130.

Solution is sprayed into the top of a tower with walls at an elevated temperature, thus creating a finely-divided suspension. Total particle residence times of no more than a few sec. are required for complete pyrolysis.

4686 Rural Water Supply and Sanitation. Forrest B. Wright. 2nd Ed. 347 p. 1956. John Wiley & Sons, New York. (9TD920 W93r)

Important aspects of water supply and sewage disposal for the rural home. Description and maintenance of pumps, valves, pipe, and other equipment.

4687* Development of a Continuous Gas Chromatographic Analyzer for Sludge Digestion Studies. Werner N. Grune, James V. Carter, Jr., and J. Peter Keenan. *Sewage and Industrial Wastes*, v. 28, Dec. 1956, p. 1433-1442.

4688* Fundamental Operating Variables in Sewage Sludge Filtration. Berne A. Schepman and Conrad F. Cornell. *Sewage and Industrial Wastes*, v. 28, Dec. 1956, p. 1443-1460.

A combined laboratory and pilot plant study to determine the effects of the principal operating variables on filtration rates and cake moistures in rotary vacuum filters.

4689* Evaluation of Broad Field Disposal of Sugar Beet Wastes. Glen J. Hopkins, Joe K. Neel, and Francis L. Nelson. *Sewage and Industrial Wastes*, v. 28, Dec. 1956, p. 1466-1474.

4690* Biological Oxidation of Oil Refinery Wastes in Cooling Tower Systems. Harold F. Elkin, Edward F. Mohler, Jr., and Lawrence R. Kumnick. *Sewage and Industrial Wastes*, v. 28, Dec. 1956, p. 1475-1483.

Treatment procedures; description of re-use system; operating results.

4691* The Microbial Oxidation of Pure Carbohydrate in the Presence of Calcium Lignosulfonate. Walter A. Lawrance and Henry N. Fukui. *Sewage and Industrial Wastes*, v. 28, Dec. 1956, p. 1484-1494.

See also: **3477** (colorimetric determination of dissolved O in water and sewage); **4084** (smoke density measurement).

RUBBER AND ELASTOMERS

4692* (English.) **The Effect of Shearing Force on the Fatigue of Rubber Sandwiches.** Kazuo Kuwae and Nobuyuki Saida. *Hitachi Review*, no. 15, Oct. 1956, p. 22-29.

4693 Carboxylic Rubbers From Scrap Vulcanized Rubber. Joseph Green and E. F. Sverdrup. *Industrial and Engineering Chemistry*, v. 48, Dec. 1956, p. 2138-2144.

Compounding techniques. Properties of vulcanizates.

4694 Hydrocarbon Composition and Viscosity - Gravity Constant of Rubber Processing Oils. S. S. Kurtz, Jr., R. W. King, and J. S. Sweely. *Industrial and Engineering Chemistry*, v. 48, Dec. 1956, p. 2232-2234.

4695* Behaviour of Rubber in Compression Under Dynamic Conditions. H. McCallion and D. M. Davies. *Institution of Mechanical Engineers, Proceedings*, v. 169, no. 57, 1955, p. 1125-1140.

Variation of stiffness, hysteresis energy absorbed per cycle, and resilience, with frequency, amplitude of deformation, and temperature.

4696 Properties and Applications of Coral Rubber—A Cis-1,4 Polyisoprene. G. Alliger, J. M. Willis, W. A. Smith, and J. J. Allen. *Mechanical Engineering*, v. 78, Dec. 1956, p. 1098-1102.

A new polymer expected to meet the requirements for heavy-duty truck and bus tires.

4697* (French.) Preheating of Rubber Covered Rollers Before Vulcanization. **Le préchauffage des cylindres caoutchoutés avant la vulcanisation.** *Revue Générale du Caoutchouc*, v. 33, no. 10, Oct. 1956, p. 878-880.

Possibilities of L.F. heating with several practical examples of the heating of cylindrical objects of various sizes.

4698* (French.) Silicone Elastomers. **Les élastomères silicones.** R. Borel. *Revue Générale du Caoutchouc*, v. 33, no. 10, Oct. 1956, p. 882-884.

Thermal and mechanical properties of these products and their processing in conventional equipment.

4699 Effects of Mixing Time on Properties Imparted to Rubber by Reinforcing Carbon Blacks. Isaac Drogin. *Rubber Age*, v. 80, Dec. 1956, p. 457-499.

Rubbers investigated were butadiene-styrene, oil-extended butadiene-styrene, a 50:50 blend of these, natural rubber, and Enjay Butyl. Reduction in mixing time resulted in higher viscosity, shorter scorch time, greater mill shrinkage, more nerve, more extrusion swell, thicker extruded gage, more weight per unit length of extrusion, duller looking and rougher extrusion, poorer dispersion, lower electrical resistivity, lower modulus, higher elongation at break, higher resistance to tear, lower heat build-up, higher torsional hysteresis, less abrasion loss, and little change in tensile strength, Shore hardness, rebound, and resistance to flex. Additional working of masterbatchs on sheet-off mill increases electrical resistivity, improves dispersion and smoothness, and reduces nerve and swell. Under suitable conditions, a Banbury mixing cycle of two minutes produces satisfactory physical properties.

4700 Electrical Stabilization of Conducting Neoprene Films. A. G. Sands and M. V. McDowell. *Rubber Age*, v. 80, Dec. 1956, p. 500-502.

Deleterious effects of moisture are reduced by a boiling-water leaching procedure prior to vulcanization.

4701 Conductive Rubber. Its Production, Application and Test Methods. R. H. Norman. *Rubber Journal*, v. 131, Dec. 22, 1956, p. 871-872, 874-876.

Effects of voltage, mechanical pressure, and cleaning the test piece on contact resistance; possible mechanisms; magnitude and avoidance of errors due to contact resistance. (To be continued.)

4702* Improved Resilience in Butyl Rubber Through Chemical Modification. H. M. Leeper, C. L. Gable, J. J. D'Amico, and C. C. Tung. *Rubber World*, v. 135, Dec. 1956, p. 413-420, 428.

A method of improving the properties of butyl rubber vulcanizates by chemical modification of the polymer with N-methyl-N,4-dinitrosoaniline.

4703* Influence of Nitrogen Dioxide on the Aging of Foam Rubber. H. L. Goebel, E. G. Bargmeyer, P. D. Brass, and J. U. Mann. *Rubber World*, v. 135, Dec. 1956, p. 421-428.

SPACE HEATING AND CONDITIONING

4704 Heating, Ventilating and Air Conditioning for a Helicopter Plant. E. V. Hunt. *Air Conditioning, Heating, and Ventilating*, v. 53, Dec. 1956, p. 67-70.

Design and construction details of installation in a new industrial plant.

4705 Calculating the Heat Requirements of a Snow Melting System. IV. Southeast Central Region. William P. Chapman. *Air Conditioning, Heating, and Ventilating*, v. 53, Dec. 1956, p. 71-74.

Basic equations and design data. (To be continued.)

4706 Ventilation of Industrial Ovens. Benjamin Feiner and Irving Kingsley. *Air Conditioning, Heating, and Ventilating*, v. 53, Dec. 1956, p. 81-89.

Design and operation of industrial ovens used to dry and bake coatings.

4707 How Temperature and Altitude Affect Fan Selection. A. N. Rogers. *Air Conditioning, Heating, and Ventilating*, v. 53, Dec. 1956, p. 92-96.

4708 Types and Applications of Power Roof Ventilators. Robert H. Avery. *Air Conditioning, Heating, and Ventilating*, v. 54, Jan. 1957, p. 57-62.

A classification of the types and their field of application as well as other positive aids for the intelligent and systematic selection and installation of power roof ventilators.

4709 Outlet Characteristics That Affect the Downthrow of Heated Air Jets. Linn Helander, S. M. Yen, and Wilson Tripp. *Heating, Piping & Air Conditioning*, v. 28, Dec. 1956, p. 109-116.

Increase in downthrow and/or thermal spread of the jet is shown, analytically, to be realizable by modifications in the design of a downward-discharge unit heater with an outlet of fixed diameter, under certain conditions. A method for evaluating outlet characteristics is described.

4710 Radioactive Process Ventilation. S. H. Glassmire and J. P. Wahlen. *Heating, Piping & Air Conditioning*, v. 28, Dec. 1956, p. 117-121.

Summary of the unique requirements of laboratories handling radioactive materials.

4711* Performance of a Flat-Plate Solar Heat Collector. G. T. Ward. *Institution of Mechanical Engineers, Proceedings*, v. 169, no. 35, 1955, p. 1091-1112.

Relation between efficiency of collector, plate temperature, and rate of insolation for constant rates of flow of circulating water.

4712 (German.) Refrigeration Handbook. **Handbuch der Kalteteehnik. v. IV.** Refrigerants. **Die Kältemittel.** J. Kuprianoff, Rudolf Plank, and H. Steinle. 490 p. 1956. Springer-Verlag, Berlin. (TP492 P69h)

Fourth of a series of 12 volumes in this field. Discusses the important thermal, physical, chemical, physiological, and economical properties of refrigerants. Special attention is paid to halogenated hydrocarbon derivatives as the most useful type.

4713 Heat and Mass Transfer on the Outside of Cool Air Ducts. R. Landsberg. *Research Council of Israel, Bulletin*, v. 5C, Mar.-June 1956, p. 147-150.

Sweat-water formation increases heat transfer considerably. This mass transfer depends on diffusion actuated by the difference between the dew point of the surrounding air and the surface temperature of the air duct.

4714 Transactions, American Society of Heating and Air-Conditioning Engineers. v. LXII. 590 p. 1956. Society at the Office of the Executive Secretary, New York. (TH7201 Am35t Vis.)

Includes 33 papers on theory, equipment, and operating procedures.

See also: **3830** (heat dissipation; transistor vs. tubes); **3872** (cooling of electronic equipment); **3875** (cooling of electronic equipment); **4650** (plastic duct systems).

TEXTILES, FIBERS, LEATHER, AND PAPER

4715* The Application of Electrical Instruments for Measuring Moisture Contents of Textiles. *American Dyestuff Reporter*, v. 45, Dec. 17, 1956, p. 935P-945P.

Types of instruments and the variables which affect their performance.

4716* Effect of Latex Compounds on the Dyeing of Spun Viscose Rayon Carpeting With Selected Fast to Light Direct Dyes. *American Dyestuff Reporter*, v. 45, Dec. 31, 1956, p. 965P-971P.

Results of tests with twelve dyes.

4717* Practical Considerations in Waterproofing Leather. C. W. Mann. *American Leather Chemists Association, Journal*, v. 51, Dec. 1956, p. 634-646.

A new dynamic test which employs a tapping and rubbing action to apply stress to a specimen in contact with a wet surface. Water-resistant characteristics of leather for different applications.

4718* Amino Acid Composition of Different Proteins Prepared From Skins and Hides of Indian Animals. S. M. Bose and B. M. Das. *American Leather Chemists Association, Journal*, v. 51, Dec. 1956, p. 647-656.

The amino acid composition of collagen, reticulin, elastin, albumin, globulin, mucoids, myosin, and keratin was determined by two-way paper chromatography.

4719 An Investigation of the Adsorption of Detergent and Builders Onto Cotton and Soil by Radiotracer Methods. Thomas F. Boyd and Rubin Bernstein. *American Oil Chemists' Society, Journal*, v. 33, Dec. 1956, p. 614-619.

4720 Extraction of a Lignin Fraction From Maple Wood by Liquid Ammonia. M. M. Yan and C. B. Purves. *Canadian Journal of Chemistry*, v. 34, Dec. 1956, p. 1747-1755.

Lignin fraction yielded half its weight as subfractions that were nearly uniform in composition and whose cryoscopic mol. wt. in dioxane were all near 1000. Behavior toward methanolysis, toward oxidation with periodate, and in a sulfite cook is described.

4721* (English.) **Lateral Order Distribution of Native Cellulose.** Yoshizo Tsuda and Sadataka Mukoyama. *Chemical Society of Japan, Bulletin*, v. 29, no. 7, Sept. 1956, p. 748-752.

The fractional dissolution method is the best method to obtain the lateral order distribution in both native and regenerated cellulose fibers.

4722* (English.) **Irreversible Photobleaching of the Solution of Fluorescent Dyes. II. Photobleaching of the Alcoholic Solution of Eosine in Vacuo. III. Photoreaction of Eosine in the Aqueous Alcoholic Solutions Under Evacuated State.** Masashi Imamura and Masao Koizumi. *Chemical Society of Japan, Bulletin*, v. 29, no. 8, Nov. 1956, p. 899-903, 913-918.

4723* The Chemistry of Extractives From Hardwoods. XXVII. The Structure of Terminolic Acid. F. E. King and T. J. King. **XXVIII. The Occurrence of 3 : 4 : 3' : 5'-Tetrahydroxy- and 3 : 4 : 5 : 3' : 5'-Pentahydroxy-Stilbene in *Vouacapoua* Species.** F. E. King, T. J. King, D. H. Godson, and L. C. Manning. *Chemical Society, Journal*, Nov. 1956, p. 4469-4480.

4724 The Chemistry and Technology of Leather. v. I. Preparation for Tannage. Fred O'Flaherty, William T. Roddy, and Robert M. Lollar, editors. American Chemical Society Monograph Series No. 134. 495 p. 1956. Reinhold Publishing Corp., New York. (TS967 Of4c)

The histology and composition of animal skins and the operations performed on these skins during beamhouse practice.

4725* Wood Particle Board—A Giant in the Making. Gerard P. Urling. *Forest Products Journal*, v. 6, Oct. 1956, p. 363-365.

Production and utilization of board made of machined wood particles bonded together with a synthetic resin adhesive. Typical physical and mechanical properties based on tests of commercial particle boards.

4726* Technical and Practical Considerations in Veneer Drying. Arthur S. Holden, Jr. *Forest Products Journal*, v. 6, Nov. 1956, p. 459-463.

Reviews recent studies in the field and new tools which increase production and aid in control of the final moisture content of veneer before it is assembled into plywood.

4727* Effect of Wood-Structure Orientation on Smoothness of Knife-Cut Veneers. John F. Lutz. *Forest Products Journal*, v. 6, Nov. 1956, p. 464-468.

Smoothness is affected by orientation of wood fibers, annual rings, and wood rays with respect to plane of cut. It can sometimes be improved by sawing and mounting bolts and flitches in such a way as to present a favorable orientation of the various wood structures to the lathe or slicer knife.

4728 Conservation of Water in the Pulp and Paper Industry Through Recycle, Re-Use, and Reclamation. Howard B. Brown. *Industrial and Engineering Chemistry*, v. 48, Dec. 1956, p. 2151-2155.

Conservation practices result in lower consumption per unit of production.

4729 Treated Felts. Malcolm W. Riley. *Materials & Methods*, v. 44, Dec. 1956, p. 90-93.

Treatments such as impregnation and lamination result in improved properties.

4730 Bond Tester for Coatings. J. E. Guillotte and C. P. MacDermott. *Modern Packaging*, v. 30, Dec. 1956, p. 157-160, 211.

An evaluation of the Perkins-Southwick instrument indicating that it will measure quantitatively and reproducibly the adhesion of polyethylene to paper.

4731* How IRC Nylon Behaves in Carpets. III. T. G. Finzel and S. M. Fok. *Modern Textiles Magazine*, v. 37, Dec. 1956, p. 33-34.

Crush, recovery, and matting characteristics of the carpets.

4732 Preparation of Pulps by the Sulphate Process From *Eucalyptus Rostrata* Grown in Israel, and Their Bleaching. M. Lewin and A. Lengyel. *Research Council of Israel, Bulletin*, v. 5C, Mar.-June 1956, p. 181-214.

A study of cooking conditions, properties of the sulfate pulps, and the bleaching of these pulps. Species compare favorably with other hardwoods.

4733* The Disperse Dyes—Their Development and Application. R. K. Fourness. *Society of Dyers and Colourists, Journal*, v. 72, Nov. 1956, p. 513-527 + 4 plates.

This thirteenth John Mercer commemorative lecture concerns those "water-insoluble dyes originally introduced for dyeing cellulose acetate, and usually applied from fine aqueous suspensions". Mechanical and physical means of dispersion are described as well as the dyeing process proper, and the behavior of dye mixtures especially in jig dyeing. The chemistry of the dye-molecule and application of the dyes to new synthetic fibers are discussed.

4734* The Importance of Temperature and Relative Humidity in Light Fastness Testing. K. McLaren. *Society of Dyers and Colourists, Journal*, v. 72, Nov. 1956, p. 527-537.

Humidity, which is of extreme importance, must be controlled for any reliable evaluation.

4735* The Hydrochloric Acid-Binding Capacity of Hide Powder in Sodium Chloride Solutions. P. M. Heertjes and Oei Hoo Djoen. *Society of Leather Trades' Chemists, Journal*, v. 40, Nov. 1956, p. 346-360.

A method is given for calculating the acid-binding properties of collagen as a function of pH.

4736* Investigations on Bating. II. The Laboratory Evaluation of Bating Activity. G. H. Green. *Society of Leather Trades' Chemists, Journal*, v. 40, Nov. 1956, p. 361-377.

Determination of proteolytic activity of enzymes.

4737* The Rayon Cellulose Method Applied to the Steeping of Pulp in 35, 50, and 73% Caustic. E. P. Samsel and R. W. Swinehart. *Tappi*, v. 39, Dec. 1956, p. 889-896.

Pulp solubility reaches a maximum at about 10% caustic and a minimum at some point between 35 and 50% caustic. Steeping in 10 to 50% caustic liquors causes a slight drop in viscosity. A partial insolubility effect was observed when pulps steeped in 18 to 21.5% caustic were dissolved in cupriethylenediamine solvent for intrinsic viscosity measurements.

4738* Relative Toxicity of Disinfectants Available for Use in the Pulp and Paper Industry. 1955 and 1956 Supplements. J. H. Conkey and John A. Carlson. *Tappi*, v. 39, Dec. 1956, p. 32A, 34A.

Inhibiting concentrations, active ingredients, and availability of 41 materials.

4739 The Effect of Treatment in Aqueous Phenol Solutions on the Physical Properties of Secondary Cellulose Acetate Filaments. R. Jeffries and H. J. Wellard. *Textile Institute, Journal (Transactions)*, v. 47, Nov. 1956, p. 549T-566T.

4740* Static Electrification of Filaments. Theoretical Aspects. S. P. Hersh and D. J. Montgomery. *Textile Research Journal*, v. 26, Dec. 1956, p. 903-913.

A theoretical model based on the band structure of the solid state is proposed in order to describe the transfer of charge when two solids are rubbed together. Theory is applied to data on static electrification of filaments rubbed together under controlled ambient and mechanical conditions.

4741* A Study of Blended Woolen Structures. III. Amplification and Extended Application of the Theory of Blend Statistics. Myron J. Coplan and William G. Klein. *Textile Research Journal*, v. 26, Dec. 1956, p. 914-924.

Suitable statistical criteria were derived for use with experimental methods of measuring blend composition which involve gravimetric analysis of finite lengths of yarn, roving, or Ag.

4742* Cellulose Interactions With Certain Textile Resins. E. E. Lineken, S. M. Davis, and C. M. Jorgensen. *Textile Research Journal*, v. 26, Dec. 1956, p. 940-947.

Infra-red data and other evidence that chemical reactions take place between cellulose and formaldehyde, melamine formaldehyde resins, and urea formaldehyde resins. These reactions are involved in the imparting of high wrinkle recovery properties.

4743* What Radioisotopes Can Do for Textiles. Robert W. Pinault. *Textile World*, v. 107, Jan. 1957, p. 77-80.

Acting as watchdogs, tagged atoms incorporated into yarn lubricants, sizing formulas, bleach baths, dyebaths, coating mixtures, and many other materials and processes can tell the processor exactly what is going on. The ability to detect variations in operating conditions is up to 10-million times greater with isotopes than by other known analytical methods.

See also: **3576** (composition of turpentines); **4664** (potential new textile fibers); **4683** (papermill waste water turbidity measurement); **4684** (pulp - mill odor abatement); **4685** (recovery of chemicals from sulfite liquor).

WELDING AND JOINING

4744* (German.) Wire Rope Couplings of Aluminum. **Drahtseilklemmen aus Aluminium.** P. Krekel. *Aluminium*, v. 32, no. 12, Dec. 1956, p. 778-780.

A firm friction-joint is made by pressing rope against rope and coupling against rope.

4745 A Strain Gage for the Measurement of Strains in Adhesive Bonds. Charles B. Norris, William L. James, and John T. Drow. *ASTM Bulletin*, no. 218, Dec. 1956, p. 218TP-227TP.

A method of measuring tensile strain in a thin adhesive bond between metallic adherends, by measuring change in electrical capacitance.

4746* Welding of Aluminium. D. H. Keneally. *Australasian Engineer*, v. 49, Oct. 1956, p. 65-66.

Advantages of argon arc welding in various branches of industry.

4747* (Russian.) Automatic Arc Welding of Titanium. **Avtomaticheskaia elektrodugovaia svarka titana.** S. M. Gurevich and S. V. Mishchenko. *Avtomaticheskaia Svarka*, v. 9, no. 5, Sept.-Oct. 1956, p. 1-12.

Successful welding of Ti demands a protective atmosphere. Describes a process for flux welding sheets over 2 to 2.5 mm. thick.

4748* (Russian.) Welding Three mm. Thick IX18N9T Steel in a Carbon Dioxide Protective Atmosphere. **Svarka nerzhaveiushchei stali marki IX18N9T tolshchinoi 3 mm. v zashchitnoi srede uglekislogo gaza.** A. G. Potap'evskii. *Avtomaticheskaia Svarka*, v. 9, no. 5, Sept.-Oct. 1956, p. 13-18.

Study of properties of welds made with Sv-IX18N9T and EI-613 wire on sheet steel. Welds have satisfactory mechanical and chemical properties and resist corrosion.

4749 Low Silica Fluxes for Automatic Welding and for Facing. I. I. Frumin, D. M. Rabkin, V. V. Podgaetskii, I. K. Pokhodnya, and E. I. Leinachuk. *Henry Brutcher Translation No.* 3800, 29 p. (From *Avtomaticheskaya Svarka*, v. 9, no. 1, 1956, p. 3-20.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 10284, v. 5, Aug. 1956.

4750 Inert-Tungsten-Arc Butt Welding of Zircaloy-2 Tubes. J. W. Lingafelter. *Hanford Atomic Products Operation (U. S. Atomic Energy Commission)*, HW-43049, Rev., Aug. 1956, 23 p. (UF767 Un3.1hw Contin.)

Mechanical, metallurgical, and corrosion testing of duplicate test samples indicated that strong, ductile, and corrosion resistant welds can be produced.

4751* Solder Aluminum to Other Metals. Kenneth V. Lutz. *Industry & Welding*, v. 30, Jan. 1957, p. 74-76, 78-79.

Some pertinent hints. Data on properties of metals, typical solders, applicability of solders and fluxes to various production processes.

4752 Precautions to be Observed in Silver Brazing. A. W. Swift. *Machinery (London)*, v. 89, Dec. 28, 1956, p. 1462-1463.

Effect of clearance between parts on joint strength; application of flux; supporting fixtures; heating techniques.

4753* Polymeric Adhesives for Glass. Frank Moser. *Plastics Technology*, v. 2, Dec. 1956, p. 799-803, 805.

Polymeric adhesives and glass should have certain characteristics in common with respect to expansion and contraction coefficients, flexibility, and chemical groups. Polar materials containing such functional groups as $-OH$, $-COOH$, $-C=O$, and $-COOCH_3$ are suitable. Various combinations of the epoxies, butyrals, polyvinyl acetate, copolymer vinyl chloride-acetate-alcohols, and polyacrylates are commonly used for adhesive formulation. Polarity is often a convenient guide in selecting materials, and can be established by determining contact angles by the captive bubble method. Several compounds generally are desirable in adhesives since resin combinations or plasticizer additions may result in improved strength or physical properties. Modifications of polyvinyl butyral have proved satisfactory, giving bond tensile strengths of 1600 to 5500 psi. in certain phenol combinations. Phenolic- and vinyl-butadiene acrylonitrile, neoprene-base, thiokol, silicone, rubber-base, and epoxy types are desirable for commercial use, depending on the bond characteristics desired.

4754* (French.) Low Cost Argon Shielded Arc Welding of Aluminum and Its Alloys. **Étude économique du soudage a l'arc sous argon de l'aluminium et de ses alliages.** J. G. Young. *Revue de l'Aluminium*, v. 33, no. 236, Oct. 1956, p. 953-962.

Economic aspects.

4755* (French.) The RIV-CLE Tubular Rivets and the Assembly of Metal Sheets Accessible on One Side Only. **Les rivets RIV-CLÉ et l'assemblage des toles accessibles d'un seul coté. III.** Conditions for Setting the Rivets and Mechanical Characteristics. **Conditions de pose et charactéristiques mecaniques.** B. Adaridi. *Revue de l'Aluminium*, v. 33, no. 236, Oct. 1956, p. 963-967.

4756* (Russian.) Effect of Metallurgical Factors on Structure and Mechanical Properties of Type 18-8 Deposited Metal. **Vliianie metallurgicheskikh faktorov na strukturu i mekhanicheskie svoistva naplavlennogo metalla tipa 18-8.** V. S. Stroev and I. N. Vornovitskii. *Svarochnoe Proizvodstvo*, no. 11, Nov. 1956, p. 15-19.

Metallographic and analytical studies. Effect of size and orientation of austenite grains.

4757* (Italian.) Technology of Soldering and Brazing. **Technologie della brasatura e saldobrasatura.** Problems in the Design of Soldered and Brazed Joints. **La progettazione dei giunti brasati e saldobrasati.** Mario Macuz. *Tecnica Italiana*, v. 21, no. 7, Nov. 1956, p. 457-466.

4758* (German.) Creep Resistance of Soft Soldered Joints. **Dauerstandfestigkeit von Weichlotnähten.** P. Grassmann. *VDI Zeitschrift*, v. 98, no. 35, Dec. 1956, p. 1929.

The shearing resistance of soft soldered joints under long-time load is only a tenth of the values obtained by the short time test.

4759 High-Frequency Continuous Seam Welding of Ferrous and Nonferrous Tubing. H. B. Osborn, Jr. *Welding Journal*, v. 35, Dec. 1956, p. 1199-1206.

New materials, faster welding speeds, higher quality of weld and ability to weld thinner-walled stock are claimed as advantages for the H. F. process.

4760 New Iron-Powder Electrodes and Their Applications. Robert Shutt. *Welding Journal*, v. 35, Dec. 1956, p. 1207-1213.

Fast fill, fast follow, fast freeze, and weldability are listed among the requirements to be considered when selecting an electrode for a given application.

4761 Welding of Molybdenum Heat Exchangers. R. E. Monroe and D. C. Martin. *Welding Journal*, v. 35, Dec. 1956, p. 1222-1225.

The feasibility of producing complex welded components in currently available arc-cast Mo was demonstrated by the construction of simulated heat exchangers. Assemblies containing 52 tubes welded into a header sheet were completed with no failures occurring as a result of room-temperature brittleness of the welds.

4762 Welding of Nickel-Aluminum Bronze. John L. Cahill. *Welding Journal*, v. 35, Dec. 1956, p. 1226-1230.

Procedure using Al-bronze filler wire with the inert gas-shielded metal-arc process for welding Ni-Al bronze propellers is applicable in various positions with little or no preheat required.

4763 Time-Temperature Dependence of Austenitic Stainless-Steel Welded Joint Components. J. Heuschkel. *Welding Journal*, v. 35, Dec. 1956, p. 569S-581S.

Some phenomena involved. Corrective procedures for existing materials.

4764 Metal Finish Seam Welding. W. J. Allen and M. L. Begeman. *Welding Journal*, v. 35, Dec. 1956, p. 597S-603S, 615S.

Considerable similarity was found between the schedules for mash seam welding and finish seam welding. With proper conditions, a good finish surface can be consistently maintained on one side of the sheets.

4765 The Welding of High-Strength Aluminum Alloys in Heavy Sections. Willis G. Groth and Richard A. Matuszeski. *Welding Journal*, v. 35, Dec. 1956, p. 616S-622S.

Investigations indicate that 5154 and 5056 Al alloys in heavy sections handle satisfactorily and have mechanical property advantages over 6061 alloy for many applications.

4766 A Dew Point-Temperature Diagram for Metal-Metal Oxide Equilibria in Hydrogen Atmospheres. W. H. Chang. *Welding Journal*, v. 35, Dec. 1956, p. 622S-624S.

Useful as a working guide for furnace brazing in H atmospheres.

4767* (German and French.) Comparative Heat Tests With Acetylene-Oxygen and Propane-Oxygen. **Vergleichende Wärmeversuche mit Azetylen-Sauerstoff und Propan-Sauerstoff.** C. G. Keel and E. Aebi. *Zeitschrift für Schweisstechnik*, v. 46, no. 11, Nov. 1956, p. 255-258.

Evaluation of gas-welding procedures.

See also: **3705** (adhesives); **4174** (welding of stainless steel); **4203** (corrosion of steel welds); **4253** (thermo-mechanical treatment of welds); **4318** (strength of welded steel structures); **4329** (fatigue strength of welds); **4331** (tensile strength of brazed rods); **4399** (ultrasonic testing of fillet welds).

MISCELLANEOUS

4768 Making Effective Use of Research and Development. *American Management Association, General Management Series No.* 180, 1956, 55 p. (HD28 Am35g Vis.)

Problems and possibilities in frontier research. Measuring research effectiveness. The president's job in research and development. Directing the work of engineers and scientists.

4769* (French.) Recent Progress in Safety Control of Mine Cables. **Récents progrès en matière de contrôle de la sécurité des câbles d'extraction.** Y. Verwilst, G. Jacques, and J. Strebelle. *Annales des Mines de Belgique*, no. 6, Nov. 1956, p. 970-993.

A study of pull and wear of mine cables during hoisting. Pull was measured with a new apparatus allowing a 5 to 10% margin of error. The point of maximum wear was determined with a new magnetic device now officially used.

4770* **The Condition of Regularity in Simple Markov Chains.** J. Gani. *Australian Journal of Physics*, v. 9, Sept. 1956, p. 387-393.

Generalization of Bartlett's proof; an elementary alternative.

4771 Detection of Group Invariance or Total Symmetry of a Boolean Function. E. J. McCluskey, Jr. *Bell System Technical Journal*, v. 35, Nov. 1956, p. 1445-1453.

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A concise record of 14,000 advertisers with essential facts concerning them, including name, address, business, executives, advertising appropriation, types of media used, character of distribution, and other pointers of value.

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See also: **3837** (Boolean algebra); **4579** (dynamical principle for classical mechanics).